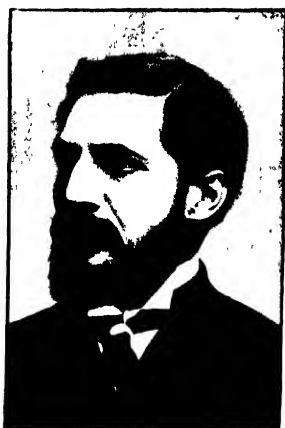


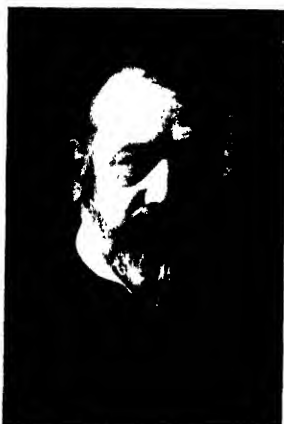
R.0224

THE NEW
POPULAR ENCYCLOPEDIA

PORTRAITS OF MEN OF THE TIME.—XI.



W. M. Flinders Petrie



John Pollie



A. W. Pinero



Sir Isaac Pitman



Lord Playfair



Sir E. J. Poynter



Sir Richard Quain



Louise de la Ramée ("Ouida")



William Ramsay

. The portraits, with the exception of Mlle. de la Ramée ("Ouida"), are from photographs by Messrs. Elliott & Fry

The New Popular Encyclopedia

A General Dictionary of the
Arts and Sciences, Literature
Biography, History, Geography
&c.

A New and Revised Edition of the Popular Encyclopedia
with
A Supplement in every volume
and
An Extensive Series of Plates in Colour and in Black-and-White

Issued under the General Editorship of
CHARLES ANNANDALE, M.A., LL.D.
Editor of Ogilvie's "Imperial Dictionary"

Assisted by
MANY SPECIALISTS
IN
THE VARIOUS BRANCHES OF HUMAN KNOWLEDGE

Volume XI

THE GRESHAM PUBLISHING COMPANY
LONDON AND GLASGOW
1902

LIST OF PLATES AND MAPS.

VOLUME XI.

	Page
PORTRAITS OF MEN OF THE TIME - - - - -	<i>Frontispiece.</i>
PHOTOGRAPHY.—I. The Three-colour Photographic Process, in Colour - - -	59
Do. II. Photographic Cameras and Appliances - - - - -	59
PISCICULTURE.—Illustrations of the Art of Breeding Fish artificially - - -	99
POLARIZATION OF LIGHT.—Polarization Figures produced by Quartz and other substances, in Colour - - - - -	164
POLYCHROMY.—I. Colour as applied by the Greeks in Architecture and Sculpture, in Colour - - - - -	179
Do. II. Colour as employed in Byzantine Architecture—Interior of Palatine Chapel, Palermo, in Colour - - - - -	179
POMPEII.—Atrium or Entrance Hall of Ancient Roman House at Pompeii, in Colour -	189
PRINTING.—I. Albion Hand Press, Linotype Machine, &c. - - - - -	293
Do. II. Hoe Sextuple Newspaper Machine, Stop-cylinder Machine, &c. - - -	295
PROTOZOA and CŒLEENTERATA - - - - -	323
RAILWAYS.—I. Permanent Way, Tunnels, Bridges, &c. - - - - -	428
Do. II. Plan of Terminus, Switches or Crossings, Rails, Sleepers, Chairs, &c. -	428
Do. III. Carriages and Wagons - - - - -	431

NAWAB SALAF JUNG KANDHUT

Potemkin, pot-yom'kin
 Potoki, po-tot'ki
 Potomac, po-to-má'k
 Potosí, pot-o-sá'; common
 pron., pot-to'sé
 Pot-pourri, pó-pó-ré
 Pottinger, pot'in-jér
 Pouchet, pó-shá
 Poudrette, pó-dret'
 Poughkeepsie, po-kép'si
 Pouquerville, pók-vél
 Poussin, pó-sán
 Powan, pou'án
 Powell, pó'el
 Pozoblanco, pó-thó-blán'kó
 Pozzuoli, poz-ú-ó'le
 Prades, prá'd
 Pradier, prá-di-á
 Præd, prá'd
 Præmuniur, pré-mú-ní'ré
 Præneste, pré-nest'é
 Prague, prag
 Pratique, pra-tík'
 Praxiteles, prak-sít'e-léz
 Precedence, pré-sé'dens
 Precedent, pré-se'dent
 Preceptory, pré-sep'to-ri
 Préfet, pré-fá
 Preislan, prents'la
 Pressané, pré-akh-ná
 Prevez, pré-vé-sá
 Prevost D'Exiles, prá-vó deg-
 zá
 Prevost-Paradol, prá-vó pá-
 rá-dol
 Prévôt, prá-vó
 Priapus, pri-á'pus
 Pribram, prá'hé brám
 Pribylov, pri'bí-lof
 Prixeaux, prí'dé
 Pilulki, pri-ly'ki
 Primates, pri-má'téz
 Primaticcio, pré-má-tich'ó
 Prirend, pri-rend'
 Pritzwalk, príts'váik
 Privas, pré vá
 Proboscis, pró-bos'sis
 Proccacini, pró-kát-ché'né
 Procidia, pró-chi-ú
 Procrustes, pró-kru'stéz
 Prometheus, pró-mé'thús
 Propylea, pró-pí-lé'a
 Propolis, pró-pó'sis
 Protogoras, pró-tag'o-ras
 Proteus, pró-tú
 Protogene, pró-to-jén
 Protogenes, pró-tó'y'e-néz
 Frotuza, pró-to-zó'a
 Froudon, pró-dón
 Froust, prout
 Provence, pró-váhs
 Rovina, pró-vah
 Frudhon, pró-dón
 Frurigo, fru-rí-gó
 Fruth, próth
 Frynne, prin
 Fryzemyl, práhem'ái
 Psalmianzer, sál-ma-ná-zér
 Psammithicus, sám-met'í-
 kus
 Psittacidae, sit-as'í-dé
 Psoriasis, psó-rí-a-sis
 Psyche, sí'khe
 Psychological, sí'ki-kál
 Psychology, sí'kol-ó-ji
 Pteralmigan, tár-mí-gan
 Pterichthys, té-rik thís

Pteroceras, ter-o'-se-ras Pterodactyl, ter-o-dak'til Pteromys, ter'o-mis Pteropoda, ter-op'o-da Pyretogota, ter-i-gó'tus Ptolemais, tol-e-má'is Ptolemy, tol'e-mi Ptomaine, tó'ma-in Puente-Jenil, pu-en'tá-he-ní' Puerto-Cabello, pu-er'tó-ká-bel'yó Puerto - Principe, pu-er-tó-prin'si-pá Pufendorf, pó'fen-dorf Puget, pó'jet Pugin, pó'jin Pulsne, pó'ni Pulci, pul'chó Pulque, pul'ká Pultusk, pul'tusk' Purniah, pur'ní-á Purpura, pur-pú-ra Pushkin, push'kin Puteaux, pí-tó Puteoll, pí-tó'o-li Puy, pí-é Puy-de-Dôme, pí-é-dé-dóm Pwllheli, pul'há-lí Pyæmia, pí-é-mi-a Pycnogonum, pik-nog'o-num Pygmalion, pig-má-li-on Pyiades, pí'ia-déz Pylorus, pí-ló'rus Pyramus, pí-ra-mus Pyrenées, Basses-, bá-sé-pé-rá-ná Pyrenées, Hautes-, ót-pé-rá-ná Pyrenées-Orientales, pé-rá-ná-zó-ré-ah-tál Pyrethrum, pí-reth'rum Pyrites, pí-rít'éz Pyrolusite, pí-rol'ú-alt Pyrope, pí-róp Pyrosuma, pí-ró-só'ma Pyrotechny, pí-ro-tek-ni Pyroxylene, pí-rol'ak-lín Pyrrho, pí-ró Pyrrhus, pí-irus Pythagorus, pí-thag'o-ras Pytheas, píth'é-as	Q Quadriga, kwod-rí'ga Quadrumana, kwod-ró'ma-na Quamash, kwám'ash Quamoclit, kwam'ók-ilit Qu'appelle, ka-pel' Quaregnon, ká-ren-yón Quarnero, kwár-ná-ró Quatre-Bras, ká-tr-brá Quatrefores de Bréau, ká-tr-fash dé brá-ó Quatrefoil, kwá'tér-foil Quay, ké Quebec, kwé-bek' Quebracho, ké-brá'chó Quedlinburg, kwed'lin-burh Quentin, St., sán kán'tá-tá Querard, ká-rár	Querétaro, ké-rá'tá-ró Quesnay, ká-ná Quesnel, ká-nel Quetelet, kál-lá Quetoedo-Villegas, ké-vá'dó-vil-yá'gas Quiberon, kéb-rón Quibor, ké'bor Quichua, ké'chuy-á Quillimane, kí-li-má'ne Quillota, kí-l'yó'ta Quilos, kél'o-á Quilon, kwí-lon' Quimper, kan-pár Quimperlé, kan-pár-lá Quinalt, ké-nál Quinet, ké-ná Quinoa, kwí-nó'a Quintana, kí-ná'tá Quipo, Quipu, kwip'o, kwip' Quirinus, kwí-rí-nus Quirites, kwí-rít'éz Quito, ké'tó	R Raab, ráb) Raasay, rá'sá Rabat, ra-bá' Rabelais, ráb-lá Rables, rá-bi-éz Raccachout, rak'ka-hót Raceme, ra-sém' Rachel, rá-shell Rachis, rá'kis	Rachitis, ra-kí'tis Racine (town U.S.), ra-sén' Racine (French author), rá-sén Raconon, rak-kón' Radeberg, rá'dé-berá Radetzky, rá-detá'ki Rae, rá Ragee, ra-gé' Ragnarök, rag-na-rék Ragout, ra-gó' Raistes, rá-a-tés-á Rai Bareli, rí ba-rá'is Raibolini, rí-bo-ló'né Raigarh, rá-i-gar' Raimondi, rí-mon'dé Raipur, rí-púr Rais, rá ó rais Rajmahal, ráj-ma-hál' Rajputana, ráj-pu-tá'na Rakoczy, rá-kó'tei Rále, rái Raleigh, rá'i Ramadan ram-a-dán' Rámáyana, rá-m-á'ya-na Rambootan, rá-m-bó'tan Rambouillet, rámb-bó-yá Rameau, rá-mó Ramee, ra-mé' Ramezes, rá-me-séz (ram Rameswaram, ra-mes'wa- Ranie, ra-mé' Ranilles, rá-mi-yé Rammohun, ram-mó'hun Rannagar, rá-m-na-gar' Rampur, rá-m-pór Rancé, ráh-sá
--	--	--	--	---

THE NEW POPULAR ENCYCLOPEDIA

A DICTIONARY OF GENERAL KNOWLEDGE

PETER'S PENOE. See **PETER PENOE.**

PETERSWALDAU, a town of Germany, in the Prussian province of Silesia, 84 miles to the south-west of Breslau. It contains the castle of the Count of Stolberg-Wernigerode, and has manufactures of cotton, cigars, starch, &c. Pop. (1895), 6999.

PETERWARDEIN (Hungarian, *Petervárad*), a town in Hungary, on the right bank of the Danube, 45 miles north-west of Belgrade. It stands partly on a steep rock and partly on a flat below, and is the strongest fortress on the Danube. Opposite to it is the town of Neusatz, with which it communicates by a bridge of boats and a railway bridge. The fortifications are extensive, and contain barracks for a garrison of 10,000 men; but the town itself is small. It has, however, four churches, a military hospital, an arsenal, a high school, and a trade in wine and fruit. Extensive marshes in the neighbourhood make the place unhealthy. A great victory was gained here (5th August, 1716) over the Turks by Prince Eugene. Peterwardein was occupied by the Hungarians in the civil war of 1848-49. It surrendered to the Austrians 6th September, 1849. Pop. (1890), 3777.

PETIOLE, in botany, the lower part of a leaf, usually called the *stalk*. When the vessels and fibres of the leaves expand immediately on leaving the stem the petiole is wanting, and the leaf is said to be sessile. In general, however, it is distinctly marked, and is usually either round, or half-cylindrical and channelled on the upper side. In the poplar it is strongly flattened at right angles to the blade, and hence the remarkable movement observable on the least breadth of wind, especially in the aspen. Sometimes, as in the garden sweet-pea, the petiole is furnished with a kind of border or wing. In many umbelliferous plants its base is dilated into a broad membranous inflated sheath. In grasses and various other plants it consists of a sheath embracing the stem; in the pea tribe the apex of the petiole is often changed into a tendril. In one section of the genus *Astragalus* (tracanth) it hardens into a spine after the leaflet drops. The petiole in some Australian species of *Acacia* and *Eucalyptus* is flattened into a leaf-like expansion, occupying the place of the true leaf; such petioles have received the name of *phylodia*.

PÉTION DE VILLENEUVE, JÉRÔME, a French revolutionary statesman, originally an advocate at Chartres, where he was born in 1753, was chosen deputy, by the tiers-état of that city, to the states-general in 1789. He at first acted in concert with Mirabeau, but later he opposed him. In December, 1790, he was elected president of the National Assembly, and in June following he became president of the criminal tribunal of Paris. He was elected

mayor of Paris November 14, 1791, and in consequence of his implication in the attack on the Tuileries, June 20, 1792, was suspended from his functions, July 6, but restored by the Assembly on the 13th. As head of the Commune he supported the demonstrations of the lower classes and the arming of the people, and when, on 20th June, 1792, the crowds forced their way into the Tuileries, he left Louis for a considerable time to his fate. At 4 o'clock in the afternoon, however, he made his appearance, and by smooth words prevailed on the people to withdraw. When the Marseillaise arrived in the capital for the purpose of overturning the throne, Pétion received them like brothers; but before the final storm broke out he went, on the 10th of August, to the Tuileries at the king's desire in order to concert measures of defence. This, however, proved of no avail. His behaviour on the 10th of August has by some been interpreted as the result of weakness, and by others as the effect of design to avoid betraying his character as an abettor of the violence. Being nominated a deputy from the department of Eure and Loire to the Convention, he became the first president of that assembly. Soon after the death of the king, Pétion was accused of having contributed to the massacres of September; but against this charge he successfully defended himself. He now, however, became the object of jealousy to Robespierre, and was included in the proscription of the Girondists, May 31, 1793. (See GIRONDISTS.) He made his escape, with some other deputies of the same party, to the department of Calvados, where they in vain endeavoured to avail themselves of the insurrections against the Terrorists. Some time after, the body of Pétion, with that of Buzot, one of his confederates, was found in a field in the department of the Gironde half-devoured by wolves, and it was supposed that he had perished from hunger. His works were printed in 1793 in four vols. 8vo. His manuscript memoirs were published in 1866.

PETITION (to Parliament). The right of the subject to petition the king is recognized in the Bill of Rights, and all commitments and prosecutions for such petitioning are declared illegal. By a law of Charles II. (13 Charles II. stat. i. cap. v.), which has been held not to be repealed by the Bill of Rights, the soliciting, labouring, or procuring the putting the hands or consent of above twenty persons to any petition to the king or either house of Parliament, for alterations in church or state, unless by assent of three or more justices of the peace of the county, or a majority of the jury at the grand-jury at the assizes or sessions, and repairing to the king or Parliament to deliver such petition with above the number of ten persons, is subject to a fine of £100 and three months' imprisonment.

Some temporary laws were passed to restrict petitioning in 1819. By the forms of the houses of Parliament certain regulations must be complied with by petitioners, or their petitions will be rejected. A petition to the House of Lords must be addressed 'To the Lords Spiritual and Temporal in Parliament assembled'; the form of address to the House of Commons is, 'To the Honourable the Commons of the United Kingdom (or to the Honourable the Knights, Citizens, and Burgesses of Great Britain and Ireland) in Parliament assembled.' The petition must begin, 'The Humble Petition of . . . sheweth; if from an individual it must state his name; address and occupation must be cited. After statement of the grievance the petition must conclude with a specific prayer. No mere recital of grievances without specific statement of the remedy prayed for, will be received. Immediately before the signatures the petition must close with the words 'And your petitioners, as in duty bound, will ever pray.' One signature at least must be on the same sheet or parchment as the petition. The signatures or marks of the petitioners must be made by themselves, not by agents, however deputed. A chairman cannot sign for a public meeting, but the common seal of the corporation is received for a corporate body. The petition must be written, not lithographed, on paper or parchment, without erasures or interlineations. It must be in English, or accompanied by a translation the correctness of which is certified by the presenting member. Intemperate language or imputations on the conduct of Parliament or courts of justice are not permitted in petitions, nor reference to debates on measures in contemplation. Petitions for the remission of customs or duties can only be presented with the consent of the crown. The member presenting a petition is understood to examine if the forms have been complied with, and all petitions presented are subjected to a scrutiny in committee. Petitions addressed to members of Parliament for presentation to His Majesty or either house of Parliament are transmitted free by post if under 2 lbs. in weight. They must be sent in covers open at the sides.—The mode of obtaining redress for the improper election of a member of Parliament is by petition to two judges of the King's Bench Division of the High Court.

PETITION OF RIGHT. The conflict between the crown and the Parliament had already begun, in the reign of James I., when (1621) the House of Commons framed the famous protestation that the liberties, franchises, privileges, and jurisdictions of Parliament are the ancient and undoubted birthright and inheritance of the subjects of England. This protestation James, with his own hand, tore out of the journal. The arbitrary measures of the second Stuart reign, the forced loans, benevolences, taxes imposed without consent of Parliament, arbitrary imprisonments, the billeting of soldiers, &c., finally determined the Commons to prepare a law which should protect the rights of the subject against further invasion; this they called a *petition of right*, as implying that it contained merely a corroboration or explanation of the ancient constitution, not any infringement of the royal prerogative, or acquisition of new liberties. It passed the Commons and the Upper House (1628), and after some attempts on the part of Charles I. to evade it, received the royal assent. After reciting the grievances above enumerated it provides against their repetition as contrary to the laws and statutes of the realm and the rights and liberties of the subject, and prays the king to declare that his officers and ministers should serve him according to the laws and statutes of the realm. See *BRIT.*—*Bill of Rights*.

PETITIO PRINCIPII, in logic, the taking a thing for true, and drawing conclusions from it as such, when it requires to be proved before any inferences can be deduced from it.

PETIT JURY. See *JURY*.

PETIT TREASON. See *TREASON*.

PETŐFI, SANDER, a Hungarian poet, born of humble parentage in the county of Pesth in 1823, received but a slender education, and had to maintain a hard struggle in youth, partly as a common soldier, partly as a subordinate member of a troop of strolling players. In 1843 he made accidentally at Pesth the acquaintance of Vachot, who perceived his literary turn of mind, and employed him on his journal called the *Divatlap*. The poems contributed by Petőfi to this periodical became immensely popular, and soon made their author regarded as the national bard of Hungary. In 1847 he undertook with Jókai the editing of the *Eletképek*, to which he furnished numerous poems and some highly successful tales. He was less fortunate as a novelist, and his *Et hóhér kötele* (the Hangman's Cord) was an especial failure. In March, 1848, he came forward at the head of the youth of Pesth with the celebrated twelve national requisitions, and made the revolutionary cause triumphant for the time. His spirited lyric *Most vagy soha* (Now or Never) was the first manuscript printed in Hungary without the supervision of the censor. He now exchanged the pen for the sword, and joined Bem's army, who appointed him his adjutant, but in consequence of a quarrel with Mézáros, who would not overlook his inattention to military discipline, he quitted the service in May, 1849, and returned to the cultivation of the muses. On the advance of the Russians, however, he again joined Bem as adjutant, and is believed to have perished in the battle of Schässburg, though doubts were long entertained as to his being really dead. Numerous pieces were composed by him amid the din of war, and a collection of his glowing battle-songs, written at this period, was published at Leipzig in 1851, and afterwards translated into German under the title of *National Songs of the Magyars*. A critical edition of his works was published in three vols. in 1894.

PETRA, a ruined city, formerly the capital of Arabia Petraea, to which it is supposed to have given its name, in a narrow valley of the Wady Musa, surrounded by lofty and for the most part precipitous mountains, about 110 miles s.e. of Jerusalem. It is mentioned in Scripture (2 Kings xiv. 7; Isaiah xvi. 1) under the name of Selah, was taken by Amaziah, king of Judah, who changed its name to Joktheel; and from the notices of it by Strabo, Pliny, Josephus, and various Christian writers, appears to have been a place of considerable extent and great magnificence, and to have at one time commanded a large share of the traffic of the East. It contains a number of remarkable rock-temples, &c., and covers a large space with its ruins, but the only building actually standing, though in an imperfect and dilapidated state, bears the name of Pharaoh's House, and seems to have been a palace. It is in the form of a square, 34 yards each way. The four walls are nearly entire, and the east one is surmounted by a handsome cornice. The front facing the north was adorned with a colonnade, of which four pillars are still standing; and within the colonnade is a piazza, from which three apartments are entered, one of them by a noble arch from 35 to 40 feet high. There is also a ruined theatre, which was capable of accommodating between 8000 and 4000 spectators. Another ruin is called the Treasure-house, and is believed by the people of the place to contain somewhere buried in it the treasures of Pharaoh.

PETRARCOH (FRANCESCO PETRARCA), Italian lyric poet and scholar, was the son of a Florentine exile, Pietro or Petrarco di Parenzo, a notary of the republic and the friend of Dante, with whose faction he was exiled. He was born at Arezzo, 20th July, 1304. His earliest years were spent in Tuscany, in the vale of Arno, and afterwards with his father at Carpentras, near Avignon, where he began his studies. He afterwards studied law at Montpellier from 1318 to 1321, and at Bologna 1321–24. His own inclinations, however, led him to study the Latin and Provençal poets in preference to law and scholastic divinity, and he was not diverted from this preference although his father repeatedly burned his books. His mother died in 1324, and his father in the following year; and being without means he adopted the ecclesiastical profession, but without formally taking orders, and returned to Avignon, where his talent for Latin poetry commended him to the court of Pope John XXII. It was at this time that he first saw in the church of St. Claire, on 6th April, 1327, the Laura who exercised so great an influence on his future life, and dictated to him his most famous works. The identity of this personage, and whether she was a real or ideal one, has been much disputed. The latter point has been settled by the poet himself in favour of the reality of Laura; the former is still open, but the common, and doubtless the correct opinion is, that she was the daughter of Audibert de Naves, born in 1308, married in 1325 to Hughes de Sade, and who died in 1348. When the poet met her she was nineteen years of age, and two years married. The love for Laura which haunted Petrarco during the greater part of his subsequent life appears to have been purely Platonic, thanks, in the first instance at least, mainly to the virtue of the lady. He remained at Avignon three years, singing his love, and haunting her at church and in her walks. He then left Avignon for Lombez, afterwards visited Paris, Brabant, Ghent, the Rhine, Aix-la-Chapelle, Cologne, &c., and imagining a vision from Laura requesting him to return to Avignon, he returned. While here he pleaded with success before the pontifical court the rights of Azzo di Correggio, prince of Parma. The pope also conferred on him a canonry at Lombez (1335). In 1336 he embarked at Marseilles for Rome, the antiquities of which he visited with an enthusiasm which he has recorded in his poems. In 1337, after an excursion in the Pyrenees and the west of Spain, he returned to Avignon, and bought a small estate at Vaucluse, in order to be near Laura. From his own inclosure he could now see her walking in her park, which was a great happiness to him. He remained here for three years, and wrote numerous sonnets in which he has attested the fact. These sonnets acquired popularity even before the earlier and longer work of Dante (which was still in manuscript), and served to fix the Italian language. These sonnets were, however, only his recreation. He rested his hopes of fame on his Latin scholarship. Virgil, Cicero, and Livy were his favourite authors, but he was a diligent explorer of the monasteries for old manuscripts of all the Latin classics (he did not learn Greek till comparatively late in life), which he transcribed with his own hand, and diffused as much as possible, while he formed a precious collection of his own. In his travels he made valuable discoveries, which have placed his name high among the restorers of letters. He had advanced views for his age of history and science, despising legends and astrology, and recommending true research. In politics his views were equally advanced, and while he did not spare the vices of the clergy he had no sympathy with the scepticism which was common among the scholars of his day. His

Latin works, both in prose and verse, were highly esteemed, and in 1341 he was called to Rome to receive on Easter-day the laureate crown awarded for his poem *Africa*. He was subsequently charged with various diplomatic missions, and in 1342 was appointed joint-ambassador with Rienzi to Clement VI. to solicit his return to Rome. The mission was unsuccessful, but Clement gave him a mission to Naples. He praised the enterprise of Rienzi (1347) in a Latin epistle, and went to Rome, though too late, to support him. At Parma he learned the death of Laura, which he recorded on his copy of Virgil, and celebrated in his *Triumphs*. He at first thought of shutting himself up in a monastery, and determined to live more in accordance with his ecclesiastical profession. His great popularity, however, caused him to be employed in many important diplomatic negotiations. He was consulted by the pope and the emperor. In 1354 he negotiated a peace between the Republics of Genoa and Venice in the name of Giovanni Visconti of Milan. From this time, with the exception of embassies to France and Germany, he lived entirely in Italy, and until 1376 chiefly at Milan, Padua, and Venice, to the last of which he presented his library. In 1370 he took up his residence at Arquà, near Padua, where he passed his remaining years in religious exercises, and where he died on 18th July, 1374. He had two natural children by an Avignon lady—a son who pre-deceased him, and a daughter who married Francesco de Brossano, a Milanese gentleman who became his executor. Petrarca left no works in Italian prose. Among his Latin works are three books of *Epistles* (*Epistolæ familiares*) and twelve *Eclogues*, his poem *Africa*, various philosophical, religious, political, and historical treatises, as *De officio et virtutibus imperatoris*; *De vera sapientia*; *De contemptu mundi*; *Itinerarium syriacum* (a geographical work); *Epitome vitarum virorum illustrium*, &c. His Italian poems consist of Sonnets and Canzoni in vita e in morte di Laura, and of Trionfi. The first edition is dated Venice, 1470. The subsequent editions are innumerable. The Trionfi are in terza rima. Despite their refinement and delicacy of sentiment and purity of language, the sonnets of Petrarca are somewhat dull and monotonous. They are also filled, according to the taste of the age, with conceits, artificial refinements of sentiment, and plays upon words.

Of biographical and critical notices of Petrarca we may mention An *Historical and Critical Essay on the Life of Petrarca*, with a Translation of a few of his Sonnets, by Alexander Fraser Tytler, Lord Woodhouselee, Edinburgh, 1810; *The Life and Times of Petrarca*, by Thomas Campbell (the poet), London, 1841; *Pétrarque, Étude d'après de nouveaux Documents*, par Alfred Mézières, 1867 (new ed. 1896).

PETREL, a genus of *Natatorial Birds*, forming the type of the family *Procellariidae*, included in the *Longipennate* section of the order—the latter name being applied to the section from the well-developed nature of the wings in its members. The Petrels possess a rudimentary hinder toe. The upper mandible is very strongly hooked, the lower mandible being abrupt or truncated at the apex. The extremity of the upper mandible appears of a distinct piece from the rest of the bill. The nostrils form a tubular structure lying along the upper surface of the mandible. These birds are popularly termed 'Mother Carey's Chickens' by seamen. They are found in every part of the world, on the ocean, at great distances from land, and often in stormy weather. They feed on small marine animals and on almost any kind of food refuse cast overboard from ships, and appear exceedingly fond of fat or grease, for which, and for other edibles, they will

follow in the wake of vessels for great distances. These birds breed in localities adjoining the sea, forming their nests in burrows or cavities; the female lays one egg. They fly rapidly, and generally close to the water; and when in pursuit of food they suspend themselves by extending their wings, and appear to run on the surface of the water. It is from this circumstance that they are called *petrels*, after the apostle Peter, who walked on the water. The appearance of these birds is considered by seamen to presage a storm—hence the common name of a familiar species known as the 'stormy petrel'—and it is thought peculiarly unlucky to kill one of them. The family *Procellariidae* includes several sub-families, that of the *Procellariinae* including the true petrels. The Stormy Petrel (*Procellaria* or *Oceanites pelagica*) is the smallest of natatorial birds, measuring only 6 inches in length. Its general colour is a dull or sooty black, with a cross band of white on the rump. The bill and feet are black. This bird is found on the Atlantic and Mediterranean shores, including the British coasts and those of North America. The *P. Wilsonii* (*Oceanites oceanica*) is another species of petrel, inhabiting the Atlantic and Australian waters. The Fulmar (see FULMAR) is a petrel of the northern seas; whilst the Blue Petrel (*Prion vittatus*) is a southern form. The Great Black Petrel (*Ossifraga gigantea*) is a larger and more rapacious form than the other species, subsisting largely on the blubber and flesh of dead seals and whales, and is chiefly found in southern seas. The shearwater is also included among the petrels, and the albatross is allied. The Cape Petrel (*Procellaria* or *Daption Capensis*) is illustrated at the article ORNITHOLOGY.

PETRIFACTIONS. See GEOLOGY, PALEONTOLOGY.

PETRIKAU, or PIOTRKOW, a town of Russian Poland, in the government of the same name, on the river Strada and the railway from Warsaw to Vienna. It is a place of some antiquity, with a ruined castle and a fine town-house, but is now in a declining state. Pop. (1893), 23,345.

PETROLEUM, the general name given to an oily liquid found in different parts of the earth, a mixture of hydrocarbons, chiefly belonging to the marsh-gas (CH_4) series. (See BITUMEN.) Petroleum is found in almost all localities where bitumen exists in quantity in the rocks: in Burmah, Persia, on the south-west shore of the Caspian Sea (at Baku), in North America, &c. The existence of petroleum wells has long been known. Even in America the oil of the Pennsylvania wells was collected and sold by the Seneca Indians under the name of Seneca oil. It was only recently, however, that the importance of this article was discovered. Attention appears to have been first directed to it by the successful manufacture and sale of paraffin and paraffin oil in Great Britain derived from shale. (See PARAFFIN.) The enormous returns realized by the first speculators in America gave an unprecedented rapid expansion to the trade; towns rapidly sprung up in the Pennsylvanian oil district, railways were formed, and the operations have been since continually expanding. In the United States petroleum is produced chiefly by Pennsylvania, New York, Ohio, West Virginia, Colorado, California, and Indiana. In Canada also oil is obtained. It was in 1859 that petroleum first figured in the trade statistics of the United States. In that year 2000 barrels of 42 gallons each were produced in the Pennsylvania and New York oil-fields; next year the output was half a million barrels; and in 1861 it was over two millions. The first borings for oil were not very deep, and the oil was allowed to flow naturally; but when the surface

springs were exhausted intermediate strata were bored through, and new and apparently inexhaustible sources of supply were found at a depth of 600 to 3000 feet. When the boring has been made the oil often rises to the surface without the aid of pumps. Pumping is, however, resorted to when the pressure has diminished. The mode of boring is similar to that of boring for water in sinking artesian wells. Some of the wells yield 1000 or 2000 barrels a day. Philip's Well gave 3000 barrels a day for six weeks. In 1880 the total product of the oil regions of the States was 26,286,123 barrels, and in 1889 it had reached the total of 34,820,306 barrels. Of this 21,486,403 were credited to the Pennsylvania and New York fields, whilst the Ohio fields yielded 12,471,965 barrels. In 1897 the total production was over 60,500,000 barrels, the value being about £8,000,000. The value of crude and refined petroleum and petroleum products exported exceeds £10,000,000. By refining or distillation petroleum yields burning oil (kerosene or paraffin oil), lubricating oil, paraffin wax, &c. The crude oil is often conveyed from the well to the refinery through pipe lines many miles in length. Baku, on the Caspian Sea, has been known from time immemorial to be rich in petroleum, and since 1872 large quantities of the oil have been obtained from wells sunk here. In 1875 one well spouted 2400 tons of oil daily, and formed in the course of a month four vast lakes of oil. Another well discharged 8000 tons daily, the fluid rising at intervals to the height of 300 feet. From a miserable village Baku has become a large and flourishing town, its oil-refineries being among the largest in the world. The Russian oil competes successfully with the American, and in eastern Europe has driven it out of the market. Tank-ships and tank-cars have been specially built for carrying the oil. Peru also produces petroleum, but its supplies have not yet been worked to any extent. The dangerous character of petroleum has caused several acts of Parliament to be passed to regulate its storing and use.

PETROMYZON. See LAMPREY.

PETRONIUS ARBITER, CAIUS, a Roman author, notorious for his licentiousness, was born at Marseilles, and lived in the court of Nero. He was for a time the favourite of the emperor, who made him master (*elegantie arbiter*) of his voluptuous banquets and revelries. But he finally fell a victim to the suspicions of the tyrant, on account of which he put himself to death. To him many authorities attribute the *Satiræ*, a work of fiction of great ability and licentiousness, of which only fragments have been preserved. The best editions are those of Burmann (Leyden, 1743) and Bucheler (1862). The chief fragment, *Cena Trimalchionis* (The Supper of Trimalchio), has been excellently edited with German translation and notes by Friedländer (Leipzig, 1891). See the *Étude sur Pétrone* of Boissier (Paris, 1892) and of Collignon (Paris, 1892).

PETROPAVLOVSK, a village of Asiatic Russia, formerly capital of Kamtchatka, on the east coast of Kamtchatka, on the North Pacific Ocean, with a good roadstead. It was bombarded by the Anglo-French fleet in 1854.—Also a town of Central Asiatic Russia, in the government of Akmolinsk, on the right bank of the Ischim, 170 miles west of Omsk. Pop. (1893), 16,653.

PETROVSK, a town of Russia, in the government and 70 miles N.W. of the town of Saratov, on the slope of a hill crowned by the ruins of a fortress. It has a trade in corn. Pop. (1894), 15,611.

PETROZAVODSK, a town in Russia, capital of the government of Olonetz, on the Lossolenka, where it falls into Lake Onega, 192 miles north-east of St. Petersburg. Pop. (1894), 13,602.

PETTY BAG, an office of the court of chancery out of which writs issued in matters wherein the crown was mediately or immediately concerned; such as *comptes d'évêque* for bishops, &c.

PETTY OFFICERS. See **OFFICERS**.

PETTY SESSIONS, in England, are sessions of two or more justices of the peace, on which power is conferred by various statutes to try minor offences without jury, and to take cognizance of indictable offences, and commit the parties after examination of witnesses for trial at quarter-sessions or assizes. Each county in England is subdivided into petty-sessional divisions, which are arranged by the justices in quarter-sessions, to whom there is generally an appeal from the petty sessions. Each petty sessional division has a clerk, who is the legal adviser of the justices.

PEUTINGER TABLE, a map showing the military roads of the greater part of the kingdom of the Visigoths, drawn, it was formerly believed, for Theodosius the Great. It is called after Conrad Peutinger, a German scholar, born 1465, and who died in 1547. Among his papers was this famous map. Conrad Celtes, who found it in the Benedictine monastery of Tegernsee, borrowed and did not return it. Such a *mappa mundi in rotulo* was extant in that convent in 1502; and the Tabula Peutingeriana at Vienna is probably the same which Werinher, a poet, made or copied in 1190. Celtes gave this map to Peutinger, who intended to publish it. After his death it disappeared for many years, until Marx Welsler published fragments of it, under the title of *Fragmenta Tabulæ antiquæ ex Peutingerorum Bibliotheca* (Venice, 1591). It was not found entire among Peutinger's manuscripts until the eighteenth century, when Scheyb published a beautiful impression, with remarks (folio, Vienna, 1753). The manuscript of the map is at present in the imperial library at Vienna, where an additional leaf of it was some time ago discovered. The characters and figures show that the map is not the original. Dozen thinks that it belongs to the twelfth century. Impressions have been published by Mannert (1824), Desjardins (1869-70), and Miller (1888), the last on a reduced scale. Peutinger was the first who collected Roman inscriptions on stone, in a small work—*Romane Vetustatis Fragmenta* (Augsburg, 1505). He wrote, besides other valuable works, on the decline of the Roman Empire. Peutinger also held for a long period important public offices.

PEWS (Old French, *pui*, from Latin, *podium*, a parapet or balcony), inclosed seats in a church. Pews were in use before the Reformation, but are now seldom found in Roman Catholic churches on the Continent. In England pews are held in the Established Church by two tenures, first by prescriptive right, when they descend as an heir-loom independently of ecclesiastical concurrence; second, all pews not so held are at the disposal of the ordinary (bishop of the diocese) for behoof of the parish, and are under him distributed by the churchwardens to the parishioners according to their rank. The bishop may grant the right to sit in a particular pew. In the disposal of the pews or seats in the area of parish churches in Scotland parishioners have a preferable claim (for the special purpose of attending divine service) according to the valued amount of their rent. The disposal of pews or seats in Dissenting churches is of course purely a matter of private arrangement. They are commonly let to defray the congregational expenses. In America they are sometimes put up to auction.

PEWTER consists of tin alloyed with a quantity of copper, or other metallic bodies, as the experience of the workmen has shown to be the most conducive to the improvement of its hardness and colour, such

as lead, zinc, bismuth, and antimony. The best sort of pewter is formed from antimony 17 parts, tin 100 parts. The French add a little copper to this kind of pewter. A very fine silver-looking metal is composed of 100 lbs. of tin, 8 of antimony, 1 of bismuth, and 4 of copper.

PEYER'S GLANDS. See **INTESTINE**.

PEYROUSE, LA. See **LAPÉROUSE**.

PÉZENAS, a town of France, in the department of Hérault, on the left bank of the Hérault, at the confluence of the Peine, 25 miles w.s.w. from Montpellier. It is well built, has several spacious streets, the ruins of an old castle, a fine parish church, and a theatre; manufactures of linens, nappkins, muslin, moleskins, woollen and cotton covers, hats, soap, and chemical products; several cotton and silk mills, extensive distilleries; and a trade in grain, dried fruit, wood, olive-oil, capers, cotton, silk, wool, and more especially brandy and wine. Pop. (1896), 6402.

PEZOPHAPS. See **SOLITAIRE**.

PEZOPORUS. See **PARAKEET**.

PFAFF, CHRISTIAN HEINRICH, an eminent chemist and natural philosopher, born in 1772 at Stuttgart, was educated in the gymnasium there, and in the Charles Academy, where he showed a decided inclination for natural science, and became acquainted with Cuvier. His interest in electricity was first awakened by the celebrated experimenter Gross, and he made it the subject of his first literary labour, in his thesis entitled *De Electricitate sic dicta animali*. In 1793 he went to Göttingen, where he published the results of his galvanic inquiries in his work *Ueber thierische Electricität und Reizbarkeit*. He afterwards spent some time in Copenhagen; then went with a noble family as physician to Italy, and after his return practised in Heidenheim till 1797, when he accepted of an invitation to become an extraordinary professor at Kiel. After visiting Paris in 1801, at the expense of the Danish government, he returned to occupy the chair of chemistry, and rank at the same time as a member of the medical faculty. This gave him an opportunity of directing his attention particularly to pharmaceutical chemistry. He was thus led to the composition of his most important work, entitled *System der Materia Medica nach Chemischen Principien* (seven vols. 1808-24). He formed a laboratory in Kiel, and collected a rich physical apparatus, which government afterwards purchased. At the same time he took an active part in everything relating to physics and chemistry, as is apparent from his numerous papers in the journals devoted to these subjects, and also from his separate writings, among which may be mentioned *Handbuch der analytischen Chemie* (two vols., Altona, 1824-25); *Ueber und gegen den thierischen Magnetismus* (Hamburg, 1807); *Der Electromagnetismus* (Hamburg, 1824); *Parallele der chemischen Theorie und der voltaischen Contacttheorie der galvanischen Kette* (Kiel, 1845); and *Die Asiatische Cholera-epidemie im Herzogthum Holstein im J. 1850* (Kiel, 1851). He died at Kiel in 1852. His brother, John Frederick, who was born in 1765 and died in 1825, was professor of mathematics, first at Helmstadt and then at Halle, and has acquired an honourable name in the history of mathematics by his *Disquisitiones Analyticæ* (Helmstadt, 1797).

PFEFFERS, PFAFFERS, or PFAVERS, a small town of Switzerland, in the canton and 31 miles east of St. Gall. It is famous for its warm baths, situated at no great distance in the vale of the Tamina, in what has been described as one of the most extraordinary spots even in Switzerland. The baths are situated on a narrow ledge of rock a few feet above the impetuous torrent, and the buildings which form them, consisting of two piles connected by a chapel, are so deeply sunk between the rocks that the sun,

in the longest summer day, is visible above them only from ten to four o'clock. From 200 to 300 patients can be received at a time. The spring has a temperature of nearly 100° Fahr. The efficacy of the baths is undeniable, but is not easily explained, as a pint of the water contains scarcely 3 grains of saline matter. Since 1840 the water has been conveyed by pipes to the village of Ragatz, below the gorge, a distance of about 2½ miles, without losing its warmth. Ragatz is now a very favourite watering-place, being visited by 50,000 people yearly, and correspondingly extensive accommodation for visitors has been provided. Near the village is situated the ancient Benedictine abbey of Pfeffers, a vast edifice, built in 1665, and now used as a lunatic asylum under the name of St. Pirminsberg. The old residence of the abbots in Ragatz is now a hotel and bathing establishment.

PFEIFFER, IDA, an Austrian lady, noted for her extensive travels, was born at Vienna on Oct 15, 1797. Her father was a man of an eccentric disposition, giving her a boy's education, and carrying out his theories so far as to have her attired in boy's clothes. In 1820 she married Dr. Pfeiffer, a lawyer and a widower, twenty-four years older than herself. Her husband held an office under the Austrian government; but, having given offence, it is said, by his incorruptibility of principle, was dismissed from his appointment. For many years Madame Pfeiffer endeavoured to eke out a living by teaching, and, having succeeded in getting her two sons established in life, she resolved to carry out what had been her dream through life—the exploration of foreign countries. Having managed to hoard up a small sum for effecting this object, she set out in 1842 on a journey through the Holy Land. An account of her wanderings was published on her return, and excited considerable interest. Another tour was undertaken by her in 1845 to Scandinavia and Iceland, of which she also published a narrative. In May, 1816, she started on a journey round the world, sailing from Hamburg to Rio de Janeiro, visiting the interior of Brazil, and afterwards proceeding by sea round Cape Horn to Chili, from which she crossed the Pacific to China, stopping for a short time at Tahiti. From China she proceeded by Singapore to Calcutta, crossed the country to Bombay, from which she sailed to Bassora in the Persian Gulf, travelled in a caravan to Mosul, and then, journeying through Persia and Circassia, reached Constantinople, from which she returned to Vienna by Athens and Trieste in November, 1818. She published an interesting account of this journey, which attracted considerable attention both on the Continent and in England, where a translation of it appeared. Madame Pfeiffer had now become a traveller of some note; but the main object of her wanderings seems to have been merely to gratify a strong inherent longing for seeing foreign lands, and she had no purpose to serve either in the way of scientific or ethnological investigation. She indeed disclaims all pretensions to a knowledge of science, though she formed some valuable scientific collections. The sum of £150 was now granted her by the Austrian government to prosecute her travels. In 1851 she arrived in London, from which she sailed to the Cape of Good Hope, intending to penetrate into the interior of Africa; but, abandoning the idea, she sailed for the East Indies, visited Borneo, Java, and Sumatra, and exposed herself fearlessly amid the savage tribes in these islands. Nothing is more remarkable in all the wanderings of this extraordinary woman than the undaunted courage which she, a solitary female, maintained in conjunctures which would have tried the courage of many men. After visiting the Moluccas she crossed

the Pacific to California, sailed down the west coast of America, crossed the Andes, and then returned to London in 1854, taking the United States in her way. The last journey accomplished by her included the island of Madagascar, which she visited from the Mauritius. After undergoing much suffering and privation, and narrowly escaping with her life from the hands of the diabolical Queen Ranavola, Madame Pfeiffer contrived to effect her return to Europe. Her fatigues, however, had told fatally on her constitution, and after lingering for a time she expired at Vienna on 28th October, 1858. Her work on Madagascar, published posthumously, contains an account of her life by one of her sons.

PFENNIG, a German monetary unit, equal to one-hundredth part of a mark; or 1/1748 of a penny. There are bronze coins of the value of 1 pfennig and 2 pfennige, or about ¼d. and ½d. respectively. Nickel coins valued at 5, 10, and 20 pfennige (about ¼d., 1½d., and 2½d.) are also in use, and in silver the coins less than a mark are 20 pfennige and 50 pfennige (5½d.).

PFORZHEIM, a town of Germany, in Baden, 15 miles south-east of Carlsruhe, is situated on the northern edge of the Black Forest, and at the junction of the Wurm, the Nagold, and the Enz. Among its buildings are to be mentioned the remains of an ancient castle, which was formerly the residence of the margraves of Baden-Durlach; the castle church, erected in the twelfth, thirteenth, and sixteenth centuries, containing the tombs of many of the margraves; the town-house, a handsome building, rebuilt in 1892-95; the post-office building; and the fine museum. The town also has a gymnasium and many other educational institutions. The chief industry of the place is the manufacture of trinkets, which employs over 10,000 hands, the produce being sent to the chief markets of the world. There are also chemical-works, machine-works, several establishments for the production of silver wares, forges, and tanneries. In the neighbourhood are copper-works, bleachfields, paper-mills, oil-mills, saw-mills, &c. The trade in wood is important, the timber being floated by the Enz and Neckar to the Rhine. There is also a considerable trade in oil, fruit, wine, and cattle. The trade has been materially increased by the construction of railways. The inhabitants distinguished themselves in the Thirty Years' war. Reuchlin, one of the most distinguished precursors of the Reformation, was born here. Pop. (1880), 24,037; (1895), 33,345; (1900), 43,376.

PHÆDO (Greek *Phaidōn*), of Elis, Greek philosopher, a scholar of Socrates, and founder of a school of philosophy in Elis. The dialogue of Plato on the immortality of the soul, which contains the last conversation of Socrates with his scholars while he was in prison, bears his name; but it is said that Phædo repudiated the part set down to him in the dialogue of Plato, and no inference can be drawn from it as to his teaching. None of Phædo's writings, which were in the form of dialogues, have come down to us; but Seneca, in his *Epistolæ ad Lucilium*, has a translation of an extract from one of his works. Mendemenus, who founded the Eretrian branch of the Eleatic school, was indirectly a disciple of Phædo, but to what extent he followed his views is unknown.

PHÆDRA, in Greek mythology, daughter of Minos, king of Crete and of Pasiphaë, was the sister of Ariadne and wife of Theseus. Happening to meet Hippolytus, her step-son, whom she had never before seen, and whom she did not know to be the son of Theseus, she was inflamed with an ardent passion for the beautiful youth. He would not reciprocate her passion, and to satisfy her revenge she accused him

to her husband of a criminal attempt upon her honour. The father cursed his son, and Neptune soon carried his execrations into effect by bringing upon Hippolytus a violent death. When this event was known in Athens Phædra repented of her crime and hanged herself. According to some she was killed by Theseus. Sophocles and Euripides, two of the most celebrated poets of antiquity, have taken Phædra as the subject of their tragedies, which are now lost. Racine has followed their example.

PHÆDRUS, a Latin writer of the Augustan age, who translated and imitated the fables of Æsop in iambic verse. Little is known of him but from his own writings. He was a slave brought from Thracia or Macedonia to Rome, and manumitted by Augustus. He lived in the reign of Tiberius, and seems to have suffered some oppression or injustice from the tyranny of Sejanus. Some authorities have doubted the genuineness of the fables ascribed to Phædrus, chiefly it appears on the ground of a statement of Seneca, that the Romans had not attempted fable writing, and the general silence of other Roman writers about Phædrus. The style of the fables is, however, favourable to the supposition of their genuineness. There are five books containing ninety-seven fables attributed to Phædrus, which are generally supposed to be genuine. In the prologue to the first book the author announces his work as a free translation of Æsop; in subsequent books he intimates having taken greater liberties with his subject, and introduced fables of his own under the name of Æsop. The best editions of the fables of Phædrus are those of Bentley (Cambridge, 1726), Orelli (Zurich, 1832), Lucius Muller (Leipzig, 1877), Riise (Leipzig, 1885), and Havet (Paris, 1895). Besides the above fables some have ascribed to Phædrus another group of thirty-two, the *Epitome Fabularum* or *Fabulæ Novæ*, published from a manuscript of N. Perotti, archbishop of Manfredonia in the fifteenth century.

PHÆTHON (by English writers commonly spelled *Phæton*, which name is given after the god to a light carriage), in Greek mythology, the offspring of Helios and Clymene, and brother of the Heliades. To please his unfortunate mother, and to satisfy those who doubted whether the Sun were his father, he desired the latter to grant him a favour. Helios imprudently promised it unconditionally, and swore by the Styx that he would at all events keep his word. Phæthon now asked permission to take his father's place in the chariot of the Sun, and would not be denied. But he had scarcely mounted the flaming car and taken the reins, when the celestial horses, despising their weak driver, turned out of the path, and set everything on fire. The Ethiopians, on the left, were blackened by the near approach of the Sun; and when the chariot was drawn over the earth to the right, Zeus with his bolts plunged the thoughtless charioteer into the river Eridanus or Po. His sisters found him there lifeless, and lamented him. They were changed into poplars, and their tears into amber. The god of the sun was also called Phæthon (the enlightener).

PHALANGERS (*Phalangistidae*), a group of small marsupial Mammalia, included in the *Carpophagous* or fruit-eating section of that order, and deriving their name from the fact that the second and third toes of the hinder feet are united almost to their extremities. All the feet possess five toes. The incisor teeth number six in the upper and two in the lower jaw; the canines are always of small size, those of the lower jaw being occasionally undeveloped. The tail is generally elongated and prehensile, but, as in one genus (*Phascolarctos*), it may be rudimentary. The great toes are opposable, and are destitute of nails, the other digits being provided with curved nails. These

animals are visibly adapted for an arboreal life, and inhabit the trees of the forests of Australia and the Eastern Archipelago. They are nocturnal in habits, and feed upon fruits and leaves, but appear also to devour young birds. In confinement they are found to prefer flesh as an article of diet. They are eaten by the natives of the countries in which they occur, although the flesh is said to emit a strong and offensive odour. The stomach is of simple structure, the intestine being provided with a long cæcum. The Australian Opossum (*Phalangista vulpina*) is the best-known species of Phalanger. This form is not a true opossum, the latter genus occurring solely in America. This animal is hunted by the Australian colonists. It averages about 1½ foot in length, the bushy tail being about 13 inches long. The colour is a grayish black, the under parts and inner aspects of the limbs being of a yellowish white colour. *P. carifrons* or 'Capoul' is another species, found in New Ireland. The Phalangiers proper are sometimes divided into two groups, the first of which includes those species found only in Australia and Tasmania, and possessing longish ears and a tail which is completely hairy throughout. The second group embraces Phalangiers inhabiting the islands of the Eastern Archipelago exclusively, and which possess short ears and tails with the tips bare or destitute of hairs. The natives of the Moluccas term these forms *Cuscus* or *Cousous*. *P. ursina*, *P. Cookii*, *P. maculata*, *P. fuliginosa*, *P. gliriformis* are also known species. The *Petauri* or Flying Phalangiers are also included in this family. These latter are distinguished by the possession of a *patagium* (which see)—consisting of folds of skin extending along the sides of the body between the fore and hind limbs—which acts as a parachute and supports these animals in their aerial leaps from tree to tree. They want the prehensile tails of the ordinary Phalangiers. Their fur is soft and glossy. They are nocturnal in habits, *Petaurus Tuganoides* is the largest species, and averages about 2 feet in length, inclusive of the tail. *P. striatus* is a well-known form, the fur being much valued on account of its silky texture. This species is coloured gray above, with darker colour on the head and white on the under parts. A black hue runs along the back, the patagium being marked along the sides by a similar band. A circle of black surrounds each eye; a blackish line running along the hinder limbs on their upper surface. The tip of the tail is also coloured of a darker hue. This form inhabits New South Wales. None of the Flying Phalangiers inhabit Van Diemen's Land. *P. flaviventris* and *P. murrayi* are also allied species of *Petauri*; whilst the Pigmy *Petaurus* (*P. pygmaeus*) is the smallest species, and is not much larger in size than an ordinary mouse.

The genus *Phascolarctos*, represented by the *P. cinereus*, the 'koala' or 'native sloth' or 'bear' of the Australian colonists, is nearly allied to the Phalangiers. It is, in fact, intermediate between these forms and the Kangaroos. It possesses a rudimentary tail. The thumbs and great toes are opposable to the other digits, which are provided with claws. See KOALA.

PHALANGES, the name applied to the separate bones of which the digits (or fingers and toes) of vertebrates are composed. Each digit or finger of the human hand consists of three phalanges, with the exception of the pollex or thumb, which is composed of two only. The basal or proximal phalanx of each finger—that next the palm—is the longest, and they become successively smaller; the last or terminal phalanges which support the nails being the smallest of all. The same number is followed in the toes, the great toe or hallux, like the thumb,

being formed of two phalanges only. The phalanges of the great toe are much larger than those of the other toes, and the second and third phalanges of the little toe may frequently be found ossified together. In lower vertebrates the number of phalanges varies greatly from what obtains in man. In other mammals—save in Cetaceans or Whales—the phalanges number the same as in man. In *Dasyurus villosus*, one of the armadillos, the phalanges of the three ulnar digits increase in length as they approach the end of the finger. There are fourteen phalanges in the third digit of *Globiocephalus*, one of the Cetacea. The terminal phalanges in the Cats (Lions, &c.) develop broad, bony plates for the support of the claws. The phalanges of the toes may also exceed those of man in number. The terminal phalanges of the toes bifurcate in the Short-tailed Pangolin, and those of the Cats exhibit the same conformation as the phalanges of the fingers.

PHALANGIDÆ, a family of Arachnidans, represented by the familiar Harvest-spiders (*Phalangium*), and included in the section or order of the Adelar-throsomata. The legs in the Harvest-spiders are exceedingly long. The maxillary palpi exist in the form of filamentous appendages, which terminate in simple, hooked processes. The abdomen is distinctly divided into segments or somites. These forms are not to be confused with the true spiders, from which they differ in possessing a jointed abdomen and other traces of lower organization. The Harvest-spiders are common among grass and plants. They appear to subsist on insects, and are of voracious nature. Several of the foreign species possess abdomens of remarkable conformation.

PHALANX, a word used by the Greeks (especially in the plural) to designate generally the line or ranks of an army in order of battle; more specifically the mode of formation of the heavy infantry of the Greek armies. Three Greek states acquired renown for their superior organization and use of the phalanx—Sparta, Thebes, and Macedon. In all of them it consisted of infantry in close array, heavily armed, with long spears as their principal weapon. The organization of the troops composing the phalanx varied in different states, but generally they were arranged in regular divisions under officers of various ranks, as in a modern army. The Spartan phalanx varied in depth, according to circumstances, but was commonly eight deep. It moved to the music of flutes, much importance being attached to rhythmical movement. The Theban phalanx, particularly under Epaminondas, was much deeper. At the battle of Leuctra he kept one of the two divisions into which the phalanx was usually divided retired, using it to strengthen the other wing in depth. The phalanx was perfected by Philip of Macedon. He increased the length of the spears to 24 feet, and the lines were arranged at such intervals that the spears of the fifth rank projected 3 feet in front of the first, so that the front was protected by a solid array of five lines of spears. The men were also armed with large shields which nearly covered their body, and defended by helmets, coats of mail, and greaves. The nucleus of the Macedonian phalanx was a *syntagma*, or complete square of sixteen men each way. These were combined in various groups—a chiliarchy containing four syntagmas, a merarchy two chiliarchies, two merarchies the phalanx of 4096 men, and four phalanges the great phalanx of 16,384 men. The lowest division was the lochos or enomotia, consisting of a single file of sixteen men.

PHALARIS, a ruler of Agrigentum in Sicily, celebrated in tradition for his cruelty, but of whose life and character there is little authentic information. His reign is said to have lasted sixteen years; its

commencement may be placed about B.C. 570. He was a native of Agrigentum, and appears to have been raised to authority by his fellow-citizens, and afterwards to have usurped despotic authority. He extended his dominion both by war and policy, but ultimately perished in a popular insurrection. The best known story of the cruelty of Phalaris is that of his burning his victims in a brazen bull, within which a slow fire was kindled, while their cries resembled the bellowing of the bull. It is added that he first tried this instrument of torture upon Perillus, its inventor. The story of the bull is of considerable antiquity, but the last circumstance is probably a later addition. At a later period the traditional character of Phalaris underwent a change. His cruelty was represented as due to the constraining force of circumstances upon a naturally mild disposition. He now acquired the character of a lover of literature and philosophy. It was in this last character that the spurious epistles of Phalaris were attributed to him. See BENTLEY (RICHARD).

PHALAROPE, a genus of Grallatorial or Wading Birds belonging to the Scolopacidae or Snipe family. They form the sub-family Phalaropinae. The bill is slender, and depressed at the base, the two mandibles being grooved to the apex. The extremity of the upper mandible is obtuse, and curved over the tip of the lower mandible, which latter is awl-shaped. The nostrils exist at the sides of the base of the mandibles, and are surrounded by a membranous patch. The feet are of moderate size, the toes, like those of the coots, being fringed with membranous lobes, enabling these birds to swim with great facility. The front toes are united up to the first joint. The hinder toe does not possess any membrane. The wings are of moderate size, the first and second quills exceeding the others in length. The Phalaropes exist on the sea-coasts in flocks of small size. They more rarely occur in fresh-water lakes, and are occasionally met with swimming out at sea at considerable distances from land. These birds are said never to dive. They feed on Crustacea, Mollusca, and insects, which they obtain by groping with their bills in the water. The nest is built amongst the grass on the sea-coasts. From four to six eggs are produced, and both sexes incubate. The flesh is oily and unpalatable. Their *habitat* is the far north and Arctic regions, but in winter they visit the shores of more southern and temperate lands. Two species thus visit Britain in winter. Several sub-genera are included under the chief genus *Phalaropus*. That genus is itself represented by the *P. hyperboreus* (or *fulvicastris*), the Red-necked Phalarope, which is coloured black, varied with ferruginous tints, and with red on the under parts. The winter plumage is cinereous, with white beneath. *P. platyrhynchus* is the Gray Phalarope, which possesses a wide bill, flattened at its base, the tail being long and rounded. This species is sometimes—as by Wilson—included in the sub-genus *Holopodius*. The Gray Phalarope in its winter plumage is coloured a bluish gray, with white beneath, and possesses a chestnut patch and black band on each side of the neck. This bird inhabits the Arctic circle, the eastern portions of Northern Europe, the Caspian Sea, and the northern shores of the American continent. It migrates southwards as far as Mexico in winter, and at that period may be found in Britain. The eggs are coloured greenish brown, with black spots. The sub-genus *Lobipes* is another section of the genus, and is sometimes employed to include the *P. hyperboreus* above described.

PHALLUS (Greek, *Phallos*), the male organ of generation, a symbol of the productive powers of nature in almost universal use in ancient religions. It is impossible to trace the origin of this symbolism, which is so widely diffused as probably to indicate

a spontaneous origin among different races. The source, however, from which it has spread most widely has undoubtedly been an eastern one. In Egypt this symbolism was associated with the worship of the bull Apis, and with the feasts of Osiris, the solar divinity. Elsewhere the phallus, together with the female organ of generation, represented the fertilizing powers of the sun and earth. The same symbolism is found among the Phœnicians and Babylonians, and it is one of the modes of false worship which the Jews adopted from their idolatrous neighbours, and which were continually denounced by their prophets. Similar symbols have been found in Mexico, and in India they are everywhere common to this day. (See LINGAM.) Some of the Egyptian conquerors are said to have diffused them widely on the routes of their conquests.

In Greece these symbols did not appear in the primitive mythology of the Hellenic race. They were introduced with the worship of Dionysus, and afterwards applied to that of other divinities, particularly of Demeter, Aphrodite, and Apollo. However natural may have been the analogies which led to the use of these symbols, and however general and ideal may have been the conceptions intended to be conveyed by them, they everywhere sooner or later became associated with obscenities and licentious rites. This was especially the case in Rome in the latter part of its history, where the offences produced by these rites were so great that they had to be forbidden by law. The women carried the emblem in procession from one temple to another. They wore them as amulets; and this practice subsisted long after the fall of the Roman mythology, and well on into the middle ages. It was prohibited by councils of the church at Mans in 1247, and at Tours in 1396.

PHANEROGAMS, or PHANEROGAMIA, one of the two great divisions of the vegetable kingdom, consisting of those plants which have open blossoms or organs of reproduction; the other class, *Cryptogamia*, being non-flowering, or with concealed organs of reproduction. See BOTANY.

PHANTASMAGORIA, a term applied to the effects produced by a magic-lantern.

PHARAOH, the name given in the Bible to the kings of Egypt, corresponding to the P-HA or PH-HA of the Egyptian hieroglyphics, which signifies the sun. The identification of the Pharaohs mentioned in Scripture, particularly the earlier ones, is a matter of great difficulty, owing to the uncertainty of the chronologies on both sides.

The Pharaoh mentioned in the time of Abraham cannot very well be identified. If the common Scriptural chronology is correct he was probably one of the shepherd kings, but to this conjecture no very high probability can be attached. Of the Pharaohs in the time of Joseph and Moses, although we have many more details regarding them, little more can be said, and no greater certainty exists as to their identity. (See JEWS.) The two Pharaohs mentioned in the reign of Solomon, the one who gave his sister-in-law to Hadad the Edomite, and the one whose daughter Solomon himself married likewise remain unidentified. The Pharaoh mentioned as the opponent of Sennacherib was probably the Sethos of Herodotus. Pharaoh-Necho is the first Pharaoh mentioned in the Bible whose proper name is recorded. He is mentioned by Herodotus under the name Nekós, and was probably the fifth or sixth of the Saite twenty-seventh dynasty. Pharaoh-Hophra was the second in succession after Necho. He is identified with Apries, who reigned from about 590-571 B.C., but the dates of both the beginning and end of his reign are variously stated. Several kings of Egypt are mentioned in the Bible who are not called Pharaoh.

PHARISEES, a religious sect among the Jews which had risen into great influence at the time of Christ, and played a prominent part in the events recorded in the New Testament. The Pharisees are not mentioned in the Old Testament or the Apocrypha; they are, however, commonly identified with the Assideans (that is, *chastim*, godly men) mentioned in the first and second books of Maccabees (first, ii. 42; second, xiv. 6, &c.) An improbable interpretation refers the word translated 'saints' (*chastim*) in Psalms lxxix. 2; cxvii. 10, &c., to the Pharisees. The most probable account of the origin of the Pharisees as a distinct sect is probably that which refers it to the reaction against the attempt of Antiochus Epiphanes to break down the distinctions between his Jewish and Greek subjects. Even before the time of Antiochus (see JEWS) a spirit of compromise and conformity to Gentile customs had been springing up among the Jews themselves. The Pharisees organized the national opposition to this breaking down of the ancient barriers of their faith; but their zeal, as testified by the apostle Paul, was narrow, bigoted, ignorant, and intolerant; and among the charges which our Saviour brought against them a prominent place is given to that of misunderstanding and misinterpreting their own prophets. Josephus, who was himself a Pharisee, gives in his several works brief statements of their doctrines; but his accounts are somewhat affected, and being written for Gentile ears, which he was by no means unwilling to please, they are harmonized to a philosophical diction, which was not the natural language of the Pharisees. In the second book of the Jewish War he says (chap. viii. s. 14): 'The Pharisees, who are reputed accurate expositors of the laws, and hence derive their fundamental dogma, ascribe everything to fate and God; but admit that to act rightly or otherwise rests for the most part with men, though in each case fate co-operates. Every soul they hold to be indestructible; but maintain that those of the good alone migrate into other bodies, while those of the bad suffer eternal punishment.' 'The Pharisees,' he adds, 'regard each other with affection, and cultivate public concord. The manners of the Sadducees towards each other are ferocious, and in their intercourse with their own fraternity they are as wanting in urbanity as with aliens.' The doctrines held by the Pharisees and by the Sadducees Josephus calls 'the philosophical systems' of the Jews.

The source from which the most minute and detailed accounts of the doctrines of the Pharisees are to be derived is the Mishna. This is the first portion of the Talmud, and is called by the Jews the Second Law. It is a compendium, compiled or edited by the rabbi Jehudah the Holy, who lived in the second century after Christ. It frequently refers to the opinions of Hillel and Shammai, two rabbis, heads of opposite schools, who flourished before the birth of Christ, and to Gamaliel, the teacher of Paul. It thus establishes a continuity of doctrine or tradition extending over this period. The fundamental principle of the Pharisees is that of the existence of an oral law to complete and explain the written law. 'Moses,' says the Mishna, 'received the law (the unwritten law is meant) from Sinai, and delivered it to Joshua, and Joshua to the elders, and the elders to the prophets, and the prophets to the men of the Great Synagogue.' This principle has all the conveniences and inconveniences of the apostolical tradition and succession of the Roman Catholic Church, and its development has some analogy to that of Roman Catholic tradition. The authoritative tradition of the Pharisees received in process of time additions which were not pretended to be derived directly from Moses. In Dr. Smith's Bible Dictionary these are

classified under three heads:—1st. Decisions of the Great Synagogue by a majority of votes on disputed points. 2d. Decrees made by prophets and wise men in different ages. Of these some illustrations will afterwards be given. 3d. Legal decisions of proper ecclesiastical authorities on disputed questions. These authorities comprehended both the writers of the sacred books and their approved commentators, as Hillel and Gamaliel. There was thus a continuously growing tradition, which, being of an authoritative nature, was irreversible; and the multiplicity and minuteness of the regulations it contained reduced men to the rank of children, without the power to use hand or limb except according to order.

The encroaching nature of these regulations may be estimated by the statement of the principle on which the authority of the decrees of the wise men was founded. It was called making a 'fence for the law.' Thus, if anything was forbidden in the moral or ceremonial law, the wise men took occasion to forbid what they thought might lead to it, in order to keep men far from transgression. The prohibition in Exodus and Deuteronomy to seethe a kid in his mother's milk, has thus been gradually extended until it has come to preclude partaking of milk along with or even within several hours of the eating of animal food, not excepting poultry.

The extent and minuteness of these regulations necessarily produces collision among the authorities, and to read the accounts of their various decisions is, with the mere transference of terms, exactly like reading a chapter of Pascal on the casuistry of the Jesuits. Even the prophet Elijah himself, it is said, could not take away anything from the eighteen points which had been determined on by the school of Shammai and the school of Hillel. But these celebrated schools had their differences, and one of the momentous questions on which they disputed was whether an egg might be eaten which was laid on a festival. Both were agreed that if a bird which was not to be killed laid an egg on a festival it could not be eaten, but if the fowl which laid the egg was to be killed the school of Shammai permitted the egg to be eaten, while the school of Hillel refused to permit it. But why was the eating of the egg prohibited at all? Because in Exod. xvi. 5 the people who gathered manna were ordered to prepare on the sixth day what they brought in for the seventh, hence it was held unlawful to prepare food on a Sabbath for a feast-day, or on a feast-day for the Sabbath. Now, an egg was held to be 'prepared' the day before it was laid, and as some feast-days followed the Sabbath, the egg laid on the feast day might have been prepared on the Sabbath, and to avoid this risk of offence it was deemed expedient to prohibit the eating of eggs laid on feast-days altogether. A multitude of regulations were laid for Jewish slaughter-men, and the eating of meat slaughtered by heathens was altogether prohibited. Debts due to a heathen were not to be paid within three days of a Jewish festival, and a Jewish midwife was forbidden to assist a Gentile mother.

To observe these regulations the Pharisees formed a society, which was strictly bound by reciprocal engagements to their common policy. Each member on joining it undertook before three members to remain faithful to the laws. One of the cardinal injunctions was to refrain from buying, selling, or eating anything that was not to be tithed, and to avoid any risk of this the members were forbidden to eat and drink with the people of the land, as the uninitiated, especially of the lower orders, were called.

A special distinction of the Pharisees, which is implied in what has been already said, was the respect they paid to the rabbis or doctors of the law.

The orthodox modern Jews who respect the authority of the Talmud are still under the second law prescribed by the Pharisees.

PHARMACOPOEIA (from Greek, *pharmakon*, medicine, *poiein*, to make), a book containing the prescriptions for the preparation of medicines recognized by the general body of practitioners. Up till 1863 separate Pharmacopœias were issued by the Colleges of Physicians of London, Edinburgh, and Dublin. Since then a British Pharmacopœia, issued by the medical council of the kingdom, is recognized by the whole medical profession of Great Britain.

PHARMACY, PHARMACEUTICS (Greek, *pharmakon*, drug), the art of preserving, preparing, compounding, and combining substances for medical purposes; the art of the apothecary. As these substances may be mineral, vegetable, or animal, theoretical pharmacy requires a knowledge of botany, zoology, and mineralogy; and as it is necessary to determine their properties, and the laws of their composition and decomposition, of chemistry also. In a narrower sense pharmacy is merely the art of compounding and mixing drugs according to the prescription of the physician. The preparation of medicines was at first performed by the physicians themselves, who also administered them to their patients; and it first became a distinct branch of medical science at Alexandria towards the beginning of the fourth century B.C., when some physicians devoted themselves solely to it. Afterwards it became the employment of particular individuals (*rhizotomists*, simplers), and the medical science and the apothecary's art thus became separated from each other. Mantias, a pupil of Herophilus, in Alexandria, seems to have been the author of the first Pharmacopœia, having published a work on the preparation of medicines. Zeno of Laodicea distinguished himself by the invention of a large number of compound medicines. Princes also studied the medical sciences, particularly in reference to the preparation of poisons and antidotes. Thus, Attalus, last king of Pergamus (B.C. 134), was noted for his medical skill and his knowledge of plants, and several preparations which he invented are known to us; as, for instance, an ointment of white-lead or ceruse, &c. Mithridates, king of Pontus (123–62 B.C.), invented an antidote composed of fifty-four ingredients. Heras, of Capadocia, wrote a work on pharmacy at Rome (B.C. 49). Musa, the celebrated physician to Augustus, prescribed several medicinal preparations, which afterwards continued in use under his name. A large collection of compound medicines is enumerated in the works of Scribonius Largus (A.D. 43). Menecrates, physician to Tiberius, was the inventor of the diachylon or litharge plaster. Damocrates (A.D. 47) invented and described in verse the preparation of several medicines, tooth-powder, ointments, &c. Philo of Tarsus (A.D. 23) discovered a sedative composed of opium, saffron, and other ingredients, and called from him *philonium*. Æsclepiades Pharmacion (in the time of Trajan, A.D. 97) prepared several celebrated medicines. Dioscorides, who probably flourished in the reign of Nero (A.D. 34) is distinguished for his knowledge of the properties of plants, and first exposed the fraudulent practices made use of in the composition of several medicines, and prescribed the preparation of some new ones; as, for instance, of ceruse, calamine, flowers of zinc (*nihil album*), &c. Pliny the Elder (79) also rendered important services to pharmacy by his researches in natural history. In Galen's time (160–200) several physicians in Rome employed themselves in the preparation of cosmetics. When, with the decline of the Roman Empire, science and learning became extinct in Western Europe, superstition and blind empiricism

prevailed in the medical department, and pharmacy made no progress. But in the East, particularly in Alexandria, where art and science continued to flourish, chemistry and pharmacy were cultivated with ardour by the Arabians. They studied the works of the Greek writers, and from them we derive many important improvements in the pharmaceutical art. The Caliph Almanson (754) founded in Bagdad the first public *apotheca* or druggist's shop. The names of several medicines, such as alcohol, julep, &c., are of Arabian origin, and it is most probable that we owe to them the first official dispensaries or pharmacopœias. (See PHARMACOPŒIA.) Sabor Ebn Sahel, about the middle of the ninth century, published a pharmacopœia, and in the twelfth century Abul Hassan, physician to the Caliph of Bagdad, published a similar work, which subsequently served as the standard work of the Arabian apothecaries. The Arabian apothecaries' shops were under the particular direction of the government, and were subjected to a strict supervision, particularly in regard to the quality and price of drugs. It is related of Affhin, an Arabian general, that he examined in person the medicine chest of his army, to see if everything mentioned in the dispensaries was provided. With the revival of medical science in the West arose the celebrated school of Salerno. The apothecary's trade was now (in the thirteenth century) regulated by law, and apothecaries and grocers were obliged to sell their articles at fixed prices. Apothecaries or apothecaries' halls could be established only in certain places, and two men of standing were appointed in the large towns to superintend them. The most important medicines were compounded under their inspection, and frauds were severely punished. There is a work by Saladin of Ascoli, physician to the Grand-constable of Naples, in the fifteenth century, which, besides other curious materials relating to the state of the apothecaries' trade at that period, contains a list of the books which an apothecary ought to have, with moral precepts and directions for each month. The principal pharmaceutical work of the middle ages was the *Antidotarium* of Nicholas Praepositus of Salernum, which was celebrated as early as the twelfth century. In France the apothecaries' halls were first subjected to the supervision of the medical faculty in the fifteenth century. In Germany the apothecaries were merely dealers in drugs, which they imported from Italy. The physicians also prepared their own prescriptions. In most cities the apothecaries were likewise confectioners, and the magistrates in their contracts with them stipulated for a certain quantity of confectionary to be delivered in the city-hall. The reforms of Paracelsus in medicine (sixteenth century) introduced some changes into pharmacy. Many chemical preparations were adopted, and the use of mineral specifics, as, for example, antimony and mercury, became more common. Still the operations were conducted without reference to scientific principles; but since the middle of the seventeenth century the natural sciences have continued to make great progress, and pharmacy, as well as medicine, has experienced the effects of the improvement (See APOTHECARY and CHEMISTS.) In pharmaceutical operations the apothecaries' weight is used, in which 20 grains make a scruple, 3 scruples a drachm, 8 drachms an ounce, and 12 ounces a pound. The following abbreviations and signs are used by physicians in writing their prescriptions:—

℔..... pound.
 ʒ..... ounce.
 ʒi..... drachm.
 ʒss..... scruple.
 Gr..... grain.

C..... (*congium*) gallon.
 O..... (*octane*) pint.
 f. 3..... fluid ounce.
 f. ʒ..... fluid drachm.
 ℥..... minim.
 Gut..... (*gutta*) drop.
 Cochl..... (*cochleare*) spoonful.
 Cochl. maj. (*cochleare majus*) table-spoon.
 Cochl. min. (*cochleare minus*) tea-spoon.
 Manip..... (*manipulus*) handful.
 j. i..... one.
 ss..... half.
 āā or ana.... of each. [necessary.
 q. s..... (*quantum sufficit*) as much as
 p. e. equal parts.

PHARO, a game. See FARO.

PHARO OF MESSINA. See FARO OF MESSINA.

PHAROS, sometimes used in English for *lighthouse*; in some other languages it is the ordinary term for these edifices. The name is derived from the island of Pharos before Alexandria, which protected the port of that city. On the eastern promontory of the island stood the lighthouse of Alexandria, so famous in antiquity, and considered one of the wonders of the world, built 300 years B.C. It is said to have been 500 feet high. See LIGHTHOUSE.

PHARSALIA, the plains in the neighbourhood of Pharsalus, a town of Thessaly, where Cæsar defeated Pompey B.C. 48. See CÆSAR and POMPEY.

PHARYNGOBRANCHII ('pharynx-gilled'), the name applied to the lowest order of fishes, represented solely by the Lancelet (which see)—*Amphioxus lanceolatus*. The term alludes to the breathing organs of this fish, which are constituted not by gills but by a greatly enlarged *pharynx* (or back part of the mouth), forming a chamber, the walls of which are strengthened by gristly filaments. Between these filaments a series of transverse slits open on each side, whilst the interior of this pharyngeal chamber is lined by a delicate vascular membrane, the surface of which is richly ciliated. The process of breathing is performed by the admission of water through the mouth into the dilated pharynx. This water has certain free filaments situated on the sides of the throat, passes into the pharynx, and supplies the oxygen for the aeration of the blood contained in its vascular lining membrane. The effete water then passes through the slits in the walls of the pharynx, and thus escapes into the general cavity of the abdomen, whence it is expelled into the outer world through an aperture known as the *abdominal pore*, which is situated on the lower margin of the body. The name *Branchiostoma* ('gill-mouthed'), occasionally given to the lancelet, has reference to the functions of the pharyngeal sac. See ICHTHYOLOGY and LANCELET.

PHARYNX, the term applied to the region included in the back part of the mouth and upper portion of the throat. It is the pharynx which receives the food after it has been duly masticated in the mouth, and which then transfers it to the œsophagus or gullet. The pharynx of a funnel shape, and about 4 inches in length, its walls being chiefly composed of muscular tissue. It is attached superiorly to the basilar process of the occipital bone. Its broadest part lies opposite the hyoid bone. Its lowest boundary is at the cricoid cartilage of the larynx, that is, about the level of the fifth cervical vertebra, where it passes into and becomes continuous with the narrower 'gullet.' It is loosely attached behind to the bodies of the cervical vertebrae by areolar tissue destitute of fatty elements. The internal carotid arteries run close to the sides of the pharynx, whilst laterally the pharynx is also in contact with the internal jugular veins, and with the eighth, ninth, and sympathetic nerves.

The pharynx is composed of three coats—the inner being the mucous layer, the middle a fibrous coat, and the outer a muscular layer. The muscular coat is composed of various distinct muscles, chief among which are the three constrictor muscles of each side. The inferior constrictor arises from the sides of the cricoid and thyroid cartilages; the middle constrictor takes origin from the great cornu or horn of the hyoid bone, from the lesser cornu, and from part of the stylo-hyoid ligament; whilst the superior constrictor, situated at the upper part of the pharynx, arises from the hamular process of the sphenoid bone. All of these muscles are inserted into the middle line of the pharynx, which is marked by a white, fibrous, longitudinal line or *raphe*. The stylo-pharyngeus muscle of each side is of long and slender shape, and arises from the inner aspect of the base of the styloid process. Its fibres pass between the superior and middle constrictor muscles, and are in greater part inserted into the thyroid cartilage at its posterior border. The constrictor muscles of the pharynx contract upon food and cause it to pass downwards to the oesophagus, the action of the stylo-pharyngei muscles being to draw the sides of the pharynx outwards and upwards and so to widen the cavity for the reception of food from the base of the tongue. The pharynx forms only part of the mechanism concerned in deglutition, the tongue, the palate, and its arches and muscles (see PALATE) being also intimately concerned in the process.

The fibrous connective tissue coat of the pharynx is sometimes termed the *pharyngeal membrane* or *aponeurosis*. It is situated between the muscular and mucous layers, and is thickest above, growing gradually thinner as it descends towards the oesophagus. It is attached above to the basilar process of the occipital bone, where it forms the chief support of the pharynx. The inner lining of the pharynx is the mucous membrane, a dense feltwork of fibrous connective tissue, with elastic networks infiltrated with much lymphoid tissue. The inner surface is lined with stratified squamous epithelium, except above the level of the cavity of the mouth, where it is ciliated, columnar epithelium. This membrane is continuous with that lining the nose, Eustachian tubes, mouth, larynx, and gullet. Numerous mucous glands are embedded in the connective tissue lying beneath the mucous membrane, and their ducts pass through the mucous membrane, discharging the secretion on to the free surface.

Seven apertures open into the pharynx. These are, firstly, the two *Eustachian tubes* of the ear—one on each side—which open into the pharyngeal cavity at its upper and posterior portion and near the lower turbinated bones. This portion or space is known as the *sinus of Morgagni*. The two posterior nares or hinder openings of the nostrils form the next two apertures, these being situated at the upper part of the front pharyngeal wall. The single aperture opening backwards from the mouth, termed the *isthmus faucium*, is the fifth aperture of the pharynx, this opening being placed above the root of the tongue and beneath the soft palate (see PALATE) and uvula, and having the epiglottis situated at its lower margin. The cordiform or heart-shaped opening of the larynx comes next in order, this latter aperture being guarded by the epiglottis (see LARYNX); whilst, lastly, the opening of the oesophagus or gullet, into which the pharynx itself is continued, concludes the list of the pharyngeal apertures.

PHASE, the appearance presented by the illuminated portion of the moon or of an inferior planet. In mathematics, the phase of a simple harmonic motion at any instant is the fraction of the whole period which has elapsed since the moving point last

passed through its middle position in the direction which is regarded as positive.

PHASIS, a river of Colchis (Transcaucasia, Asiatic Russia), anciently regarded as the boundary between Europe and Asia. It was afterwards held as the boundary line between Colchis and Asia Minor. It rises in a spur of the Caucasus (Moschici), and after receiving the rivers anciently called the Rhion, the Glaucus, and the Hippus, it falls into the Buxine near the ancient town of Phasis. In the early part of its course it was called the Boas. Its modern name is Rion or Rioni. Other rivers were sometimes confounded by ancient writers under the same name with this. The Phasis of Xenophon was the Araxes.

PHEASANT (*Phasianus*), a genus of Rasorial or Gallinaceous Birds, forming the type of the family Phasianidae. This genus and group are distinguished by the moderate size and compressed form of the bill, the upper mandible being distinctly arched and overhanging the tip of the lower mandible. The upper mandible is naked at its base; the nostrils are placed at the base of the mandible, and are covered by a scale; the cheeks are naked, and together with the region of the eyes are covered by a reddish skin. The wings are short; the tail being long, wedge-shaped, and consisting of eighteen feathers. The three front toes are united by a membrane up to the first joint, and the hinder toe is articulated to the tarsus. The males possess a horny, sharp, tarsal spur. These birds, now forming the favourite breeds of our game, are well-known tenants of our woods and thickets. The food consists of grains, soft herbage, roots, and insects. They are chiefly terrestrial in habits, taking short rapid flights when alarmed. The Pheasants are polygamous, the males and females consorting together during the breeding-time, which occurs in spring. The males assemble and feed together during winter, but each selects his bevy of mates in spring. The eggs are olive-brown in colour, and number twelve or fourteen, the simple or rude nest being formed amid long grass or bushes, and the female performing the entire duties of incubation. The Common Pheasant (*Phasianus Colchicus*), now fully domesticated in Britain but originally a native of Western Asia, is the familiar species. This bird is supposed to have been introduced into Britain from the banks of the Phasis (now the Rion), a river of ancient Colchis, the modern Mingrelia, a district situated on the eastern side of the Black Sea, between lat. 42° and 43° N.; 41° 19' and 42° 19' E. lon. This pheasant extends its distribution over Southern Europe, and is said even to exist in Siberia. It is the Fasiano of Italy and the Faisan of France. The date of its introduction into Britain is undecided. In Edward I.'s time the value of a pheasant was about 4d. of the then currency. The pheasant was known to the ancient Greeks and Romans. Jason was reported to have brought it from Colchis in the famous ship *Argo*. Aristophanes notices it, as also does Aristotle and Athenæus. It was in all probability introduced into Southern Europe by the Greeks or Romans.

These birds breed freely in a domesticated state. The pheasant will interbreed with the common fowl, the Guinea fowl, and even with the black grouse; and there are white and pied varieties of the common species. The hybrid produced by the union of a cock-pheasant with the common hen is termed a *Pero*. The female pheasants when old may, like pea-fowl (see PEACOCK), assume the feathers and general plumage of the males. Cases of recorded 'cocks' eggs' may be explained as the occasional produce of these aged females. The 'Ring-necked' Pheasant, so named from the presence round its neck of a white ring, is supposed to be the hybrid resulting from the breeding of the Common Pheasant

with the *Phasianus torquatus* of China. The Golden Pheasant (*P. pictus*, illustrated at the article ORNITHOLOGY) of China is a beautiful species, coloured scarlet, blue, and yellow, and having a brilliant golden erectile crest borne on the head. The Silver Chinese Pheasant (*P. nythemerus*) possesses a general white plumage, the feathers being marked by fine black lines; the under parts are coloured black. Other species inhabiting Southern Asia and the Eastern Archipelago are the Diard's Pheasant of Japan (*P. versicolor*); Reeve's Pheasant (*P. veneratus*) of China; and Sömmering's Pheasant (*P. Sömmeringii*), also found in Japan. *P. Stacii*; *P. Pucrasia* (or *Pucrasia macrolophus*) of the Himalayas; *P. albocristatus*, form species more nearly related to the true fowls, which are also members of the great family Phasianidae. The Tragopan Pheasant (*Cerionis satyra*) also found in the Himalayas, approaches the fowls. The males of this species possess peculiar bluish horn-like processes borne on the head, and wattles of a similar colour. The male plumage is coloured red with white spots, that of the females being brown. The female Tragopans want the horn-like appendages. The Argus Pheasant (*Argus giganteus*), included by some naturalists in the Peacock group (Favonine), is a large species found in Sumatra, Malacca, &c. The males of this bird measure from 5 to 6 feet from the tip of the beak to the extremity of the tail. The plumage is exceedingly beautiful, the secondary quills of the wings being each adorned with a series of ocellated or eye-like spots of brilliant metallic hues. The general body-plumage is coloured brown. The flight is feeble, owing to the length of the secondary feathers, which latter, however, assist these birds in running.

The Impeyan Pheasant (*Lophophorus impeyanus*), forming the type of the genus *Lophophorus*, is found in Nepal and on the Himalayas. The bill is broad at the base, strong, and elongated; the upper mandible projects greatly over the tip of the lower; and the tail is short, broad, and rounded at the extremity. The male is as large as a turkey, his plumage being coloured black, adorned with beautiful metallic lustres and tints. The head possesses a peculiar tuft or crest of naked-shafted feathers, exhibiting a golden green lustre. The tail is of a chestnut red, the rump being white. The colour of the females is a more sober brown, interspersed with light brown or gray. None of the Pheasant sub-family appear to be represented in America.

PHELPS, SAMUEL, actor, was born in 1804 at Devonport. He was connected with the printing trade early in life, and having come up to London was attracted to the stage. He began his career as a professional actor at York, and after performing for years in the provinces was engaged to perform leading parts at the Haymarket, London, in 1837. He was next engaged at the Covent Garden Theatre under Macready, and proved himself an actor of uncommon merit. The most distinguished period of his life was from 1844 to 1862, when he was sole or chief manager of Sadler's Wells Theatre, and as such devoted himself with great success to the production of the higher drama. About thirty of Shakspeare's plays, as well as others of the Elizabethan period were here produced, Mr. Phelps himself appearing in them with much acceptance. Subsequently he acted at various theatres in London and the provinces. His death took place on Nov. 6, 1878, some months after his last appearance on the stage. He was excellent both in tragedy and comedy, but was stronger in the latter, the great tragic parts such as Hamlet, Lear, and Othello being rather beyond his powers.

PHENACETIN, a recently introduced drug,

prepared from carbolic acid. Like antipyrin it is used to reduce temperature in fevers, being given in doses of eight grains. It is also used to relieve pain in nervous headache and neuralgia.

PHENOL, a substance obtained from coal-tar, and forming colourless, needle-shaped crystals, which are very deliquescent, have the smell of kresote, and attack the skin like that substance. The formula of phenol is C_6H_5OH . This name is also applied to carbolic acid.

PHENOMENON, in philosophy, that which appears; the apparent object of perception or consciousness considered as such, and apart from the consideration of what may be the real object perceived or cognized.

PHENYL (C_6H_5), an organic radical not known in the free state, but in combination with hydroxyl forming phenol (which see), C_6H_5OH ; and with amidogen (NH_2) forming phenylamine, or aniline, $C_6H_5NH_2$. See ANILINE.

PHERÆ, an ancient city of Thessaly, situated in the south-east corner of Pelagiottia, south of the Lake Boëbeia, 90 stadiæ from Pagasæ, its port. Admetus, and his son Eumelus, are related to have led eleven ships from Phæræ and the neighbouring towns to the Trojan War. Phæræ assisted the Athenians in the Peloponnesian war. The government was then aristocratic, but before the conclusion of the Peloponnesian war a tyranny had been established at Phæræ by Lycophron. His son Jason was elected Tagus or military commander of Thessaly about B.C. 374, in which office he was succeeded by his brothers Polydorus and Polyphron. The supreme power continued in the same family until another Lycophron was deposed by Philip of Macedon, and Phæræ with the rest of Thessaly subjected to his power. In the middle of Phæræ was the celebrated fountain Hyperia.

PHERECYDES, a celebrated sage of ancient Greece. He is regarded as the first who wrote in prose on philosophy and religion, although his expression, as is natural, inclines much to poetry. He was a native of the island of Syros, flourished in the sixth century B.C., and was a contemporary of Thales. Pherecydes considered Zeus or Aither, Time or Chronos, and the Earth, which he esteemed a chaos, as the elements of all things. He is said to have taught the doctrine of Metempsychosis, or of the immortality of the soul. He is generally stated by ancient writers to have been the instructor of Pythagoras.

PHIDIAS OF ATHENS, a celebrated Greek sculptor, who was born about 490 B.C., and flourished in the age of Pericles. According to Böttiger, Phidias executed three statues of Athena which were all in the Acropolis in the time of Pausanias. One colossal statue of Athena he cast in bronze (taken from the tenth of the spoils won on the plains of Marathon), for the temple of Athena Polias, in which she was represented as a guardian deity. Mys wrought upon her shield, in relieve, the battle of the Centaurs, from designs by Parrhasius. Near the statue stood the primitive possessor of the mount, an owl. It is related of this statue that mariners, doubling the promontory of Sunium, saw her crested helmet and the point of her spear. The second of his most famous statues was made of ivory and gold. It was denominated the statue of the Parthenon, or the Parthenos (the virgin), and measured, with the pedestal, about $41\frac{1}{2}$ English feet in height. Instead of marble he made use of ivory, which admitted of a much softer and more brilliant polish. It was in reality formed of wood, overlaid with ivory. He threw over it a garment of gold, either beaten or cast with such exquisite skill that it might be put off or on at pleasure, and could be weighed at any time by the treasurer of the temple, which afterwards

enabled him to refute the charge of peculation. The gold was taken away by Lacharis in 296. It weighed 44 talents. The eyes were of marble, let in and probably painted according to the prevailing custom. The goddess stood upright, with the ægis on her breast and a spear in her left hand. There was likewise an immense serpent or dragon near her, supposed to be that of Erichonius. In her right hand was the goddess of Victory, formed in like manner of ivory, with a vestment of gold, 4 cubits high. By her side stood the great shield, representing on the convex side the battle of the Amazons, and on the concave the battle of the Titans. The different parts of the statue, as well as the pedestal, were wrought in relief. Thus, for example, Phidias introduced himself and Pericles on the shield. The third statue, in bronze, of a smaller size, which was called emphatically the *beautiful*, on account of its exquisite proportions, was purchased by the people of Lemnos, and sent by them to the Acropolis of Athens. The Olympian Zeus of Phidias represented the serene majesty of the king of heaven, and was ranked for its beauty among the wonders of the world. Zeus was here seen sitting upon a throne, with an olive wreath of gold about his temples; the upper part of his body was naked; a wide mantle, covering the rest of it, hung down in the richest folds to his feet, which rested on a footstool. The naked parts of the statue were of ivory, the dress was of beaten gold, with an imitation of embroidery painted by Panæus, brother of Phidias. In the right hand stood the goddess of Victory, turning towards the statue, and carved, like it, out of ivory and gold; she was holding out a band, with which she appeared desirous to encircle his olive crown. In his left hand the divinity held a parti-coloured sceptre, made of various metals skilfully joined, and on the sceptre rested an eagle. Power, wisdom, and goodness were admirably expressed in his features. He sat with the air of a divinity, presiding among the judges of the games, and dispensing the laurel wreaths to the victors, calm in conscious dignity, the *beau idéal* of Greek anthropomorphism. Cicero (*De Oratore*, ii.) relates that the artist was led by a passage in the *Iliad* to imagine such a figure. The statue was surrounded with magnificent drapery, which was drawn aside only on particular occasions when the deity was to be exhibited. A sense of greatness and splendour overwhelmed the spectator. The Zeus was removed to Constantinople by Theodosius I., and was destroyed by fire in 475. From Phidias that elevated style which is so much admired is commonly supposed to have been derived, and modern antiquarians maintain that after his death Grecian art began to decline. Phidias was, moreover, an architect. By the exertions of Pericles Athens was made the most magnificent city in Greece. During his government, which lasted twenty years, the city was adorned with more costly temples, colonnades, and other works of art, than Rome, though mistress of the world, could boast in seven centuries. Every one was anxious to do something for the ornament of the city of Athena. The best materials and most skilful artists were there in abundance. Phidias superintended these improvements; and the sculptures with which the Parthenon, for instance, among other buildings, was adorned, were partly his own work, and partly in the spirit and after the ideas of this great master. Phidias received great honours from the Athenians, for whose fame he was labouring, while Pericles had the sovereign power; but he was subjected to a change of fortune when the popularity of his patron declined. He was first accused of peculation, and then of impiety for putting his own likeness and that of Pericles on the shield of Athena. He died in prison before B.C. 432. The cause of his

death is unknown. See A. S. Murray's *History of Greek Sculpture* (new edition, two vols. 1890), Waldstein's *Art of Pheidias* (1885), Gardner's *Handbook of Greek Sculpture* (two vols. 1896-97), &c.

PHIGALIAN MARBLES. The town of Phigalia, situated near the Messenian border, in the southwestern extremity of Arcadia, experienced the usual vicissitudes of Greek cities through external wars and internal factions, till it fell under the power of Macedon. The district in which Phigalia lies is almost completely surrounded by a mountain-range, which, beginning in the territory of Elia, and crossing the border of Arcadia in an easterly direction, turns south across the Messenian border, and running west again almost completely incloses the south-west corner of Arcadia in which the city lies. On one of these mountains, Mount Cotilium, to the north-east of Phigalia, was situated the temple of Apollo Epicurius, built at the time of the Peloponnesian war by Ictinus, the architect of the Parthenon at Athens. It was erected as a memorial of the gratitude of the Phigalians for the relief afforded by Apollo from a plague which afflicted them during this war, and in consequence of which he received the surname of Epicurius. In the quality of stone and excellence of workmanship it is said to have excelled all the temples of Greece, with the exception of one of Athena at Tegea. It still remains entire, and except the Theseium at Athens is the best preserved temple of Greece. It stands in a rocky glen near the summit of the mountain, surrounded by ancient oaks, and commanding a splendid view of the surrounding country. It remained unknown till it was visited by Chandler in 1765. In 1812 an extensive investigation of the temple and its site was made by a group of scientific explorers. It is built of a close-grained finely veined limestone. A thick wood of oaks covered the acclivity by which it was approached, and had long concealed the temple from view. This exploration resulted in the discovery of rich treasures of sculpture and architecture. The temple presented some peculiarities. Its orientation was north and south, instead of east and west, as is common in Grecian temples. The frieze, which was usually on the exterior of the temple, was here in the interior, and with the Metopes was of Parian marble. In the inner temple was erected a colossal statue of Apollo Musagetes, in a flowing white tunic and with a lyre in his hand. The friezes, which were the glory of the temple, consisted of twenty-three bass-reliefs, measuring 2 feet 2½ inches in height. Twelve of them represented the contests between the Amazons and the Athenians, eleven those between the Centaurs and the Lapithæ. These friezes were purchased in 1814 for £15,000 by the British government, and having been removed from the temple are now in the British Museum.

PHILADELPHIA, a city of the United States, in Pennsylvania, next to New York and Chicago the largest city in the States, 125 miles N.E. of Washington and 85 miles S.W. of New York, on the west bank of the Delaware, and extending across its tributary the Schuylkill, 96 miles from the Atlantic coast. The original city occupied an area of little more than a mile from north to south, and two miles from east to west, bounded on the east by the Delaware, and on the west by the Schuylkill, but in 1854 the boundaries were made coextensive with those of the county of the same name, and the city has now the large area of about 130 square miles. The more densely built part of it covers about 15 square miles. The district west of the Schuylkill is known as West Philadelphia, and the municipality comprises several other places, such as Germantown, Chestnut Hill, Frankford, Manayunk, Bridesburg,

and Holmesburg, which have nearly all the character of separate towns. Much of the surface near the rivers is low and flat, but towards the north and west it is undulating and somewhat broken. The streets were originally laid out so as to run nearly due westward from the Delaware, intersected by other streets running nearly north and south, but this plan, though generally conformed to in the newer quarters, had to be modified owing to the configuration of the site as determined by the curves of the rivers. Still, almost everywhere the streets cross each other at right angles. Several irregular avenues, at one time the suburban and country main roads, stretch away from the original town plot. Market Street, the great central street running east and west, and continuously built upon for over four miles, has a width of 100 feet; Broad Street, the principal central street running north and south, is built upon to a length of six miles, and is 113 feet in width. Most of the other chief streets vary from 50 to 66 feet broad, some of the avenues, however, being much wider. Delaware Avenue proceeds along the bank of the Delaware, and to the west of it are Water Street and Front Street, running north and south. West from Front Street to Broad Street the chief streets running north to south are numbered from 1 to 13, and west from Broad Street across the Schuylkill the numbering is continued from 15 to above 60. The chief streets crossing these from east to west are named from trees and the counties and governors of the state. Some of the blocks made by the intersection of the streets, instead of being built upon are formed into open squares; among which may be mentioned Independence Square, laid out in shady walks and grass-plots; Washington Square, affording an excellent promenade; and Franklin Square, with a magnificent fountain in its centre. Penn Square, one of the original city squares, is now occupied by the city-hall. In addition to the squares, the chief place of outdoor recreation is Fairmount Park, with an area of 2740 acres, possessing much natural beauty, being well-wooded and having a great variety of surface. In it is a Washington Memorial (1897). Many of the streets are well planted with rows of trees; all of them are well cleaned, lighted with gas or electricity, and abundantly supplied with water, while the principal thoroughfares are laid with the lines in connection with an efficient system of tramways. Several fine bridges, both for railway and general traffic, span the Schuylkill, the more noteworthy being that at Girard Avenue in Fairmount Park, a light and handsome iron structure 1000 feet long and 100 feet broad; the Spring Garden or Callowhill Street bridge, also of iron, and having an upper and a lower roadway 1290 feet long; and the iron and stone bridge at Chestnut Street, 1528 feet long. Ferries over the Delaware afford communication with New Jersey.

In the early period of the city's history the building material used was almost exclusively a brownish-red brick for which Philadelphia was noted; the resulting monotony was subsequently remedied by the houses being ornamented with marble facings, and steps of the same material. The chief business streets are now lined with a large number of costly and superior edifices of white and blue marble, granite, sandstone, and iron. Among the public buildings we may mention the old State House, now called Independence Hall, from the fact that the declaration of independence was signed here (4th July, 1776). It was restored to its original condition in 1897-98. The chief edifice of the city is the new city-hall, in the French Renaissance style, at the corner of Market and Broad Streets, built of white

marble on a base of granite, with a tower 547 feet high, the whole surmounted by a statue of Penn 37 feet high. The custom-house is a white marble edifice fronting both on Chestnut and Library Streets; the United States mint is a marble-fronted building in Chestnut Street; the new post-office is a magnificent granite structure with fronts on Chestnut, Ninth, and Market Streets. Other public buildings worthy of mention are the commercial and the Merchants' Exchanges, the Masonic Temple, the Philadelphia Bourse (1895), the 'Public Ledger' buildings, the Young Men's Christian Society building, the publishing house of Lippincott & Co., the Eastern Penitentiary, the United States arsenal, the permanent exhibition buildings (which were the largest of the structures erected for the Centennial Exhibition of 1876), with the annexed Memorial and Horticultural Halls; together with numerous magnificent hotels and club-houses; extensive banking, insurance, and other business premises, many of which are of considerable architectural merit.

Among the prominent ecclesiastical buildings may be mentioned the Episcopalian churches of St. Peter's, St. Mark's, the Holy Trinity, Christ Church, and St. James's; the Presbyterian churches in West Arch Street, Washington Square, the Calvary, and the Second Church; the Beth-eden and First Baptist Churches; the Central Congregational Church; the Arch Street Methodist Episcopal Church; the Lutheran Church; the Roman Catholic Cathedral of St. Peter and St. Paul, the Jewish Synagogue, &c.

At the head of the educational establishments of the city is the Pennsylvania University, housed in spacious and elegant buildings, including medical, scientific, legal, and art schools, and having under its management a commodious hospital. The Jefferson Medical College (with hospital) is one of the best in the Union. There are also colleges of pharmacy and dentistry, homoeopathic schools, the Woman's Medical College, a polytechnic college, &c.; the Academy of Fine Arts, the School of Design for Women; the Academy of Natural Sciences, the Zoological Society, the Franklin Institute, the Wagner Free Institute, the Horticultural, Philosophical, Historical, and Entomological Societies, the Drexel Institute, the Pennsylvania Museum and School of Industrial Arts, the Spring Garden Institute, &c.; numerous colleges and other educational institutions, supported by the various religious denominations; Girard College, devoted, according to the will of its founder, to the secular education of orphan boys; over 400 public schools (attended by over 120,000 pupils) at the head of which are the boys' high school, the girls' high school, and the girls' normal school. Many of the above institutions possess extensive and valuable libraries, in addition to which are the Philadelphia Library, the Loganian Library, the Mercantile Library, &c. Connected with the principal scientific institutions are valuable museums, cabinets, and collections of objects connected with the branches of learning studied by their members. Besides the art collections belonging to the Academy of Fine Arts, and kindred institutions, there are in the city some of the finest picture-galleries to be found in the country, and Philadelphia is one of the recognized centres of literary, dramatic, and artistic culture. Few cities are so munificently supplied with efficient charitable institutions, including hospitals, asylums, homes, &c., of various kinds, many of them in connection with the different religious denominations.

Accessible from the Atlantic by the largest merchant vessels, connected by navigable channels and rail with the extensive coal regions of the state, and

forming the objective point of many important railway systems, Philadelphia ranks high as a centre of foreign, inland, and coasting trade. The leading articles of export are grain, provisions, petroleum, anthracite and gas coal, iron and iron-ware, lumber, tobacco, and cotton (raw and manufactured). The principal imports consist of cotton, woollen, and flax goods, tin-plate, iron and iron-ore, chemicals and medicines, &c. The total value of imports by sea in 1900 amounted to £9,837,375; total exports, £16,229,193. The most important import and export trade is with Great Britain, from which are received textile fabrics, metals and metal goods, chemicals, &c. Lines of steamers connect Philadelphia with Liverpool, Antwerp, the West Indies, and the greater number of the important ports of the United States. Philadelphia is the first manufacturing city in the United States. There are extensive foundries and machine-shops, and locomotives in particular are turned out in large numbers. Woollens, cottons, carpets, and hosiery are among the leading manufactures of the city. There are large sugar-refineries and refineries of petroleum, chemical-works, and numerous breweries. The other leading manufactures are tools and other articles of steel or iron, clothing, boots and shoes, household furniture, &c. Printing and publishing give employment to more than 10,000 persons. Shipbuilding is also an important industry.

Philadelphia was founded and named by William Penn in 1682 as the capital of his colony of Pennsylvania. Owing to the wisdom of its founder, and his strict observance of equity in dealing with the neighbouring Indians, the city had comparatively few obstacles to struggle with, and, possessing in its site advantages of which few cities can equally boast, made rapid progress. In 1683 and the following year large parties of emigrants arrived from Germany and Holland as well as from England and Wales. They nearly all belonged to the Society of Friends, and the city continued to be almost exclusively occupied and controlled by the members of that denomination for half a century after its foundation. One of the most fortunate events in its history was the selection of it for a residence by Benjamin Franklin, to whose practical sagacity and philanthropy it was indebted for many of its most important improvements. It played a prominent part during the Revolutionary War, the Declaration of Rights having been adopted in it in 1774, and the Declaration of Independence issued from it in 1776. In 1777 it fell into the hands of the British, who occupied it for about nine months. In 1787 the convention which arranged the constitution of the United States met here; and in 1790 the first congress under this constitution, by selecting it for their place of meeting, eventually made it the capital of the Union, which it continued to be till 1800. Between 1793 and 1798 the yellow fever was extremely disastrous, the deaths within the six years being over 12,000. Philadelphia has on several occasions been the scene of very destructive riots. In 1834, 1835, and 1838 attacks were made on the abolitionists, and Pennsylvania Hall, their meeting-place, was burned down. During the Anti-Catholic riots of 1844 many lives were lost and much property was destroyed. In May–November, 1876 (a hundred years after the issue of the Declaration of Independence), the Centennial Exhibition was held on grounds at the south-west extremity of Fairmount Park. Pop. (1880), 847,170; (1890), 1,046,964; (1900), 1,293,697.

PHILADELPHISTS. See **BOEHME**.

PHILÆ, or JEZIRET EL BIRBA (that is, Temple Island), a small island of the Nile, on the borders of Nubia and Egypt, lat. 24° 1' N.; 5 miles south of

Assouan (Essouan) or Syene. It contains some remarkable monuments of the ancient Egyptians, among which are several temples, an avenue of majestic columns, several obelisks, a monolithic temple, &c. The temples are in the highest state of preservation of any in Egypt. The entire island is only about 1200 or 1300 feet in length and 450 in breadth, being sufficiently high to escape the greatest inundations, and is dominated by a granite rock at its southern extremity, which affords an excellent view of the entire island with its various monuments. There are eight temples altogether, built at different times, and dedicated to different religions. The most ancient is a temple erected by Nectanebus I., the last of the native Pharaohs, about 378–360 B.C. It is roofless, and but for the sculptures would not be taken for a temple. There is also a great temple to Isis, built by Ptolemy II., Ptolemy III., and Euergetes, 247–222 B.C. Others are of the times of the Ptolemies and Cæsars. In the eastern part of the isle is a triumphal arch of the time of Diocletian. From the numerous inscriptions on these monuments it appears that the worship of Isis was maintained in the island till the fifth century of the Christian era. There was a college of priests in it in 453. In 577 Bishop Theodore placed the temple of Isis under the protection of St. Stephen. Christianity was subsequently replaced by Mohammedanism. The sheet of water resulting from the construction of the great Nile dam of Assouan reaches to and incloses this island.

PHILEMON, EPISTLE OF PAUL TO, one of the books of the New Testament. In this short letter of twenty-five verses Paul appeals to Philemon, a wealthy and generous native of Colossæ who had been converted by the apostle, to forgive Onesimus, a former slave of Philemon's who had robbed his master and run away, but had since been also converted by Paul. This epistle, together with the Epistles to the Ephesians, Colossians, and Philipians, according to the prevalent opinion, was written from Rome during St. Paul's first imprisonment in that city. The only doubt thrown on this view by those who accept the genuineness of the epistles is contained in the suggestion supported by Meyer and others, that these epistles were written during the apostle's imprisonment at Cæsarea. Those who oppose this view, among other objections, consider it very doubtful that the apostle then had liberty to preach, as it is stated in the Acts of the Apostles that he had at Rome, and as he appears in these epistles to indicate that he had at the time they were written. The genuineness and authenticity of Philemon is questioned by very few critics. Baur, however, makes it the production of a later writer, and gives it a fictitious character, attributing it to a design to illustrate the operation of Christianity in the supposed circumstances. The Epistle to Philemon has a special interest, as illustrating the attitude assumed by the early Christians, and particularly by the apostle Paul, in relation to the institution of slavery. It has also been much and justly admired in an æsthetical point of view. There is extant a letter of the younger Pliny interceding with a friend on behalf of a fugitive slave, which has been compared by various scholars with the epistle of Paul, greatly to the advantage of the apostle, whose tact and delicacy in this epistle could hardly be exceeded.

PHILEMON AND BAUCIS, a pair celebrated in ancient Greece for their faithful affection even in advanced age. Fable (Ovid's *Metam.* viii.) relates the following story concerning them. Jupiter and Mercury travelling through Phrygia in a human form found no one willing to entertain them except this aged couple, who received them hospitably,

washed their feet, set before them a rustic meal, and prepared a couch for their repose. The deities then took their hosts to a neighbouring mountain, and when they looked behind them they saw their village sunk beneath the waves; but the cottage in which they had welcomed the pilgrims had become a magnificent temple. Jupiter promised also to fulfil all their wishes; but they only asked that they might die together as servants in that temple. At length, at a very advanced age, as they sat at the temple door they were at once transformed, Philemon into an oak, and Baucis into a linden. They were conscious of their change, which came gradually upon them, and while they were able to see and speak they took the most affectionate leave of each other. The trees were considered sacred, and long remained before the temple.

PHILEMON OF ATHENS, a Greek comedian, born about 360 B.C., began to exhibit about 330, and died about 262. He shares with Menander the honour of originating the new comedy. He was a few years earlier than Menander, but inferior to him in genius, though a greater favourite with the Athenians. The fragments of his plays extant are usually printed with those of Menander.

PHILIDOR, FRANÇOIS ANDRÉ DANICAN, was the grandson of Michael Danican, a hautboy player of the court of Louis XIII., to whom the courtiers had given the surname of *Philidor*, because he reminded the king of a celebrated Italian player named Filidori. All the family, which produced numerous musicians and composers, afterwards took the name of Philidor. André Philidor, as he was usually called, was born at Dreux in 1726. At six years of age he was admitted through the influence of his family among the children of the chapel of Louis XV. He had here the advantage of the instructions of André Campra, one of the ablest French musicians previous to Rameau. While in the service of the chapel he learned to play at chess, which divided with music the interest of his life, and to which he chiefly owes his fame. The musicians were in the habit of playing chess in the ante-room while waiting for the arrival of the king to sing mass. Philidor had long watched them, when one day an old player chancing to arrive early lamented the want of an opponent. Philidor, then about ten years of age, offered to play, beat him, and on giving check-mate immediately fled from the room in dread of corporal chastisement. At twelve years of age he had played before the king a motet with choruses of his composition, on which the king highly complimented him, and gave him a present of 10 louis. When he had finished his education he began to pursue his profession in Paris, but was compelled to eke out a living by giving lessons at miserable fees, and even by copying music. At this time he made the acquaintance of some of the leading chess-players, and excited much surprise here, and afterwards in England, by playing without seeing the board, then an unknown accomplishment, although the playing of several games simultaneously in this way is now hardly a rarity, even among provincial players, and as many as ten or twelve have been successfully attempted against good players by Paulsen, Morphy, Steinitz, Zuckertort, and others. It is amusing to read of Philidor's health suffering from these severe exercises, for which he had to prepare himself by extraordinary abstinence. Debt at length compelled him to go abroad. He went first to Holland and Germany, where he played with the best players, and published in 1748 his *Traité des échecs*. After visiting the English camp at Maastricht, and playing with the Duke of Cumberland, he went to England, where, by means of a subscription made for him by the duke, he pub-

lished his *Analyse du jeu des échecs*. His stay in England was prolonged till 1754. While here he set Dryden's *Alexander's Feast* to music. In 1754 he returned to Paris, and, together with Duni, Monsigny, and Grétry, he contributed to found the comico opera, for which he wrote many charming pieces. His operatic career was a great success. His pieces, which were numerous, were warmly received by the public, and several of them are still regarded as master-pieces of their kind. Having been pensioned for his services by the *Comédie Italienne*, he abandoned musical composition in 1788 in order to give himself up entirely to his passion for chess. In 1792 he settled in London, not, as has been alleged, as an émigré, but simply as a chess-player attracted by a pension from the London Club. He died in London in 1795. Philidor bears the reputation of having been the first chess-player of his day. He attempted innovations on the theory of the game, but his notions seem to have been narrower than those of the great Italian players who preceded him as *doctrinaires*. He substituted an opening which bears his name, the Philidor defence, for the *giuoco piano* of the Italians, which he condemned on insufficient grounds. Although his opening, which is technically styled a close one, has been greatly improved in modern practice, and is still played, it cannot compare in interest or value with the Italian open game, or even with other close games, as the French game or the Sicilian. His chess works and collections of games played by him are much valued for their antiquarian and historical interest.

PHILIP II., King of Macedon, the youngest son of Amyntas II. and Eurydice, was born B.C. 382. He passed a portion of his early years in Thebes. The explanations of this circumstance are numerous and conflicting. It seems probable that he was brought thither by Pelopidas either as a hostage or for his own security. His education in Thebes seems to have been of a practical kind. On the death of his brother Perdicas III., who was slain in battle against the Illyrians B.C. 360, he became the supreme ruler of Macedonia as guardian of his nephew Amyntas, whom he soon set aside in order to assume for himself the regal title. This measure was probably rendered expedient by the dangers to which the kingdom was then exposed, there being two pretenders to the throne, and threatened invasions by the Illyrians and Pæonians. Philip raised the courage of his subjects, and by his improvements in their military organization prepared them to meet their difficulties. The Thebans had already improved on the Spartan phalanx, and Philip carried it to the highest perfection of which it was susceptible. He purchased peace from the Pæonians. Argæus, one of the pretenders to the crown, was supported by Athens, but Philip, having defeated this pretender, dismissed the Athenians with presents, which conciliated the republic, and induced it to send ambassadors to renew the alliance between the states which had existed in the time of Philip's father. Peace was concluded B.C. 359. Philip then conquered the Pæonians, and having defeated the Illyrians forced them to accept a peace on the condition of a cession of territory. He now began to adopt an aggressive policy, which excited the enmity of the Athenians; but his subtlety was equal to his ambition, and he neglected no means to allay the suspicions of the different powers threatened by his conquests, and skillfully availed himself of their divisions and jealousies to prevent them from combining against him. Thus he secured Amphipolis, which he had formerly abandoned to propitiate the Athenians, on the pretext of delivering it up to them, and afterwards found another pretext for retaining it. He took Pydna and Potidæa (B.C. 356), and a settle-

ment of the Thasians, which he named Philippi. The last acquisition put him in possession of valuable gold mines. During the Social war, B.C. 357–355, he remained comparatively passive. Even Demosthenes does not appear at this time to have suspected the extent of his ambition. In B.C. 354 he took an opportunity to form a Macedonian party in Eubœa. He now turned his eyes to the Chersonesus, but did not at once find an opportunity for taking a decisive step in that direction. The Sacred war (see GREECE, ANCIENT) afforded him an opportunity of interfering in the affairs of Greece, of which he availed himself, and in the siege of Methone (B.C. 353) he lost an eye. This war again involved Philip with Athens, and in B.C. 352 Demosthenes pronounced his first oration against him. The immediate object of the Sacred war was accomplished by the subjugation of the Phocians. After campaigns in Thrace and Epirus in B.C. 349 he attacked the Chalcidian cities, and in B.C. 348–347 besieged and took Olynthus, the inhabitants of which he sold for slaves. The Athenians now attempted to form a coalition against him, but, failing, entered into an alliance with him. Philip next endeavoured to form a league in the Peloponnese against Sparta, which was in vain opposed by Athens. This gave rise (B.C. 344) to the second Philippic of Demosthenes. In this year he took steps to complete the subordination of Thessaly. The Athenians were at length provoked to open resistance, and in B.C. 339 they compelled Philip to raise the siege of Perinthus and Byzantium. But their success was short-lived, and the battle of Chæronea (B.C. 338) put the whole of Greece at the mercy of Philip. After this victory he behaved more magnanimously to the Athenians than to the Thebans. Philip's ambition had long extended to the invasion of Persia, and he had now the means of accomplishing it within his reach. A congress was held at Corinth, to which all the states of Greece but Sparta were invited. At this congress the war with Persia was determined on, and Philip appointed commander of the confederate forces. After a campaign against Sparta, in which he compelled her to surrender various portions of her territories to his allies, he returned to Macedon B.C. 338, and began active preparations for his expedition to the East. Next year he married Cleopatra, the daughter of Attalus, one of his generals, which caused a breach between him and his son Alexander. In B.C. 336 he celebrated with great pomp the marriage of his daughter Cleopatra with his brother-in-law Alexander of Epirus, by which he hoped to heal this division, but he was assassinated during the feast by a Macedonian youth, Pausanias, who had a private grudge against him. Alexander and his mother Olympias were suspected of complicity in the plot. His death occurred after midsummer. Philip had many of the virtues of a great ruler. He was crafty as well as bold in his measures. He was a lover of pleasure, and had many wives; but he could practise severe self-denial when he had an object to accomplish, and he was habitually magnanimous, not only from policy but from inclination. He was a liberal patron of science and literature, and his natural eloquence was of no small service in promoting the objects of his ambition.

PHILIP II., AUGUSTUS, King of France, born 1165, was crowned as successor during the lifetime of his father Louis VII., whom he succeeded in September, 1180. In April of the same year he had married Isabella of Hainaut. One of his first measures was the banishment of the Jews from the kingdom, and the confiscation of their property. This was done under pretence of their being guilty of various crimes; but the real purpose of the measure was to get possession of their wealth. Philip next

endeavoured to repress the tyranny and rapacity of the nobles, which he effected partly by art and partly by force. In 1190 he embarked at Genoa on a crusade to the Holy Land, where he met Richard Cœur de Lion (see RICHARD I.), who was engaged in the same cause in Sicily. (See CRUSADES.) The jealousies and disputes which divided the two kings induced Philip to return home the next year; and he took advantage of Richard's imprisonment in Austria to seize some of the English fiefs in Normandy. This enterprise was in direct violation of the oath by which the two princes had mutually bound themselves to attempt nothing against each other's dominions during the continuance of the crusade; and on Richard's delivery he commenced a war against Philip, which continued till the death of the former in 1199. Philip, on his return from the Holy Land, had married Ingeburga, sister of the King of Denmark; but, having taken some disgust at her, he finally procured from his bishops a divorce, under pretence of consanguinity, and married Agnes, daughter of the Duke of Méran. On the complaint of the King of Denmark the pope declared this marriage null; and on Philip's refusing to receive Ingeburga, pronounced the interdict against France.¹ The king was therefore obliged to yield, and restore her the honours of a wife and queen. (See INNOCENT III.) In his subsequent wars with John (of which an account is given in the article JOHN) Philip conquered all Normandy, Touraine, Anjou, and Maine, so that of all the British possessions in France Guienne alone remained. Philip also took part in the crusade against the Albigenses (which see). He died in 1223, after a reign of forty-three years. This prince was an able general and sovereign; he extended the boundaries of the kingdom, and contributed to raise the royal authority from a state of dependence on the great vassals. He improved the military organization of his realm, founded useful institutions, constructed roads, and favoured learning.

PHILIP IV. (LE BEL), King of France, was born in 1268, and succeeded his father in 1285. He had already (August, 1284) married Joanna, queen of Navarre, by which alliance he added Champagne as well as Navarre to the royal domain, which he made it his policy still further to increase at the expense of the great vassals. He even attempted to take Guienne from Edward I. of England, but afterwards entered into an alliance with that monarch, and gave him his daughter in marriage (1299), from which originated the claim of Edward III. on the crown of France. This peace enabled him to unite Flanders, which had been in alliance with England, to the domain of France, while Scotland, the ally of France, was given up to the vengeance of England. Under Philip France had begun to grow into a kingdom. Two-thirds of it were included in the royal domain, justice had to be administered, taxes imposed, and mercenary armies raised for conducting wars which were now too distant and protracted for the feudal troops. The Flemings, unaccustomed to arbitrary rule, revolted in 1302, and defeated at Courtrai a numerous army sent against them by Philip. Philip made vigorous efforts to repair his defeat, raised forced contributions, coined false money, and in two months brought together a numerous army. But although his military operations were attended with some success he was obliged to be contented with the cession of the Walloon territory, restoring the rest of Flanders to its count on condition of feudal homage. Philip had been engaged at the same time

¹ Agnes de Méran died of grief at Poissy in 1201, the year in which she was repudiated. The pope legitimated her two children by Philip, as she was authorized to consider the king free when she married him.

in a violent dispute with Pope Boniface VIII., who reproached him with the oppression of his subjects by arbitrary exactions and false coinage, as well as with encroachments on the rights of the church, the pontiff's real grievance. Philip was supported by the states-general, which he convoked in 1302 and 1303, in maintaining the independence of his kingdom against Boniface's unconditional assertion of the supremacy of the spiritual authority, and publicly burned the pope's bull excommunicating him. How the dispute terminated in the death of Boniface will be seen in our article BONIFACE VIII. Boniface was succeeded by Benedict XI., who died soon after; and Clement V., who succeeded him, was elected by the influence of Philip, and fixed his residence at Avignon. Clement before his election entered into a regular treaty as to the terms on which he should receive the pontificate. The destruction of the order of the Templars (1307-12), and the seizure by the king of their goods and estates, was one of the fruits of this alliance. (See **TEMPLARS**.) The policy of Philip was to some extent dictated by the condition of the kingdom, which it tended to consolidate. The abolition of the right of private coinage claimed by the barons, for example, was a good measure in itself; but as his own coinage was habitually falsified and frequently changed, and as his extortions increased with the duration of his reign, the most formidable discontents were ready to break out into open revolt at its close, which was further darkened by domestic tragedies in his own family, and by the burning of numerous persons accused of heresy. Philip left numerous ordinances for the administration of the kingdom, which mark the decline of feudalism and the growth of the royal power. He also convoked and consulted the states-general for the first time. He died 29th November, 1314.

PHILIP VI., or **VALOIS**, King of France, head of the second branch of the Capetian line, was the nephew of Philip the Bel, to whose last son, Charles IV., he succeeded in virtue of the Salique law. He was born in 1293, and succeeded to the crown in 1328. Edward III. of England claimed the crown, but did him homage under protest for Guienne. Philip's father, Charles of Valois, had headed the feudal reaction attempted by the nobles since the death of Philip le Bel, and Philip on his accession restored some of their privileges. In 1328 he defeated the Flemings in a great battle at Cassel. Edward III. and Philip, through mutual jealousy, supported each other's enemies, but Edward, having freed himself of embarrassment on the side of Scotland, and made allies of Robert, Count of Artois, and of the Flemings, who under Artevelde had revolted against their count, resolved to invade France and assert his claim to the crown. The first campaign was fought in Flanders 1338-40. In the latter year Edward returned to France, defeating the French fleet at Sluys, but shortly after concluded a treaty with Philip, and returned to England. From 1341 to 1343 the war was waged in Brittany, the succession to the dukedom of that province being in dispute, and Edward and Philip supporting different candidates. The candidate supported by Edward, and who engaged to recognize his claim to the crown, claimed through the Salique law; the candidate supported by Philip, who was his nephew, claimed against it. Edward invaded France again in 1346, and advanced to the gates of Paris, when the approach of Philip with a superior army compelled him to retreat. He fell back on the Somme, and gave battle at Crécy, where he gained his famous victory on 26th August. He then besieged Calais, which he took in August, 1347, after a siege of eleven months. A truce for ten years was concluded with

Philip on 28th September. Next year France was visited by the pestilence called the black death. Philip died on 12th August, 1360. His reign was unfortunate for France by the long war which it inaugurated, known in France as the Hundred Years' war; and he has left an evil memory by his persecutions of Jews and heretics, his confiscations and exactions. He originated the gabelle, and like Philip le Bel he frequently changed the value of money.

PHILIP II., of **SPAIN**. The position and character of this monarch, the time in which he lived, and the long duration of his reign, combine to make him one of the most important personages in modern European history. He was the son of Charles V. and Isabella of Portugal, and was born at Valladolid on 21st May, 1527. His education was intrusted to Juan Martinez Siliceo, then a professor in the College of Salamanca (afterwards Bishop of Toledo), and Don Juan de Zuñiga, commendador mayor of Castille. He acquired considerable knowledge of Latin and French, showed some capacity for mathematics, and a considerable taste for architecture, sculpture, and painting. Although Charles accuses Siliceo of carelessness, these preceptors do not appear to be responsible for the disposition Philip afterwards manifested. Even in early years he was grave and taciturn, and remarkable for self-possession and for the maturity of his utterances. Probably the admonitions as well as the example of his father had much influence in forming his character. Amid much good advice Charles inculcated on his son the maxims of absolute sovereignty which he had himself practised. It was the will of the emperor that Philip should be early accustomed to exercise his mind about state affairs. When a mere youth (1541) he intrusted the regency of Spain to Philip, along with a council headed by the Duke of Alva. In a letter of private instructions which he wrote to Philip on this occasion, the emperor says, 'The Duke of Alva is the ablest statesman and the best soldier I have in my dominions. Consult him above all in military affairs, but do not depend on him entirely on these or any other matters. Depend on no one but yourself.' In this letter he found occasion to warn his son of the dangers of libertinism. On 13th November, 1543, Philip married the Infanta Maria of Portugal, who died in July, 1545, after giving birth to a son, the unfortunate Don Carlos. (See **CARLOS**.) Charles desired to have Philip recognized as his successor in the Netherlands, and to secure for him the succession to the empire after his brother Ferdinand. For this purpose he ordered Philip to join him in the Netherlands, passing in his route through Germany. On this journey Philip tried to make himself agreeable to the German princes, but he did not succeed. He had already formed ideas of his own importance which were only suited for the society of his Spanish grantees. His manners also alienated the Netherlanders; while the Spaniards, who looked on him as their natural ruler, considered themselves injured by his withdrawal from the kingdom. Having negotiated for his son a marriage with Mary, queen of England, Charles gave him the sovereignty of Naples and Milan. Philip landed in England on 19th July, 1554, was married at Winchester on the 25th, and remained in England till September, 1555. He was recalled to receive the sovereignty of the Netherlands, which his father had resolved to abdicate. This was done in public assembly at Brussels on 25th October, 1555, and on 16th January, 1556, in the same hall he received, in presence of the Spanish grantees then in the Netherlands, the crown of Spain, with its possessions in Asia, Africa, and America. One of Charles's last acts was to negotiate a peace, one of the least favourable he ever made, with France. The

termination of hostilities was violently opposed by the pope (Paul IV.), and Henry II. was soon induced to recommence hostilities. In the meantime Philip had reluctantly, and after consulting his theologians, declared war with the pope. Alva was despatched into the Papal territories, whither he was soon after followed by Guise. Philip himself repaired to England, and induced Mary to declare war with France. The battle of St. Quentin (see ESCURIAL), fought 10th August, 1557, resulted in the rout of the only army available for the defence of the French capital, but Philip did not know how to profit by it. It enabled him, however, to make peace with the pope. Guise was immediately recalled; and Alva, left master of the situation, dictated peace (Sept. 14), and on his knees asked pardon in the name of his master for the sacrilege of which he had been guilty. The capture of Calais by Guise (7th January, 1558) avenged the battle of St. Quentin. The death of Mary followed soon after (17th November); and the Treaty of Cateau-Cambrésis (3d April, 1559) put an end to the war with France. His conduct in England has occasioned some controversy. He evidently tried to make himself popular; but the influence he possessed over Mary is quite sufficient to make it evident that he approved of all the barbarities of her reign, as nothing would have been easier for him than to have put a stop to them. One of the main inducements to the Peace of Cateau-Cambrésis was to enable both monarchs to turn their attention to the suppression of heresy. The marriage of Philip with Elizabeth of France, called by the Spaniards *Isabel de la Paz* (22d June, 1559), was designed to cement the alliance between the two pious monarchs. The principal French allies of Philip in fanaticism were the Guises; but a political danger at this time overcame even this strong bond of union, and Philip, who feared to see the crowns of England and Scotland united with that of France, protected Elizabeth, to whom he had offered his hand in vain, against a descent on England in favour of Mary Stuart. In 1559 he finally left the Netherlands, his main object in returning to Spain being to check the progress which the Reformation had made there. On his arrival in his native country, on his voyage to which he narrowly escaped shipwreck, he had the pleasure of being present at an *auto-de-fé*; and a few years' perseverance in similar measures extinguished the light of the Reformation, together with the spirit of freedom and enterprise in Spain. The cause of religion in France was also a constant subject of solicitude with Philip, but his zeal for it was occasionally disturbed by political complications. In 1562, however, he zealously exerted himself to excite opposition in that country to the edict of toleration passed at the beginning of that year. In Naples, as in Spain, his zeal led him to persecute the Protestants; but it was in the Netherlands that his bigotry and obstinacy had their most disastrous, though ultimately fortunate results. The details of the measures adopted by his agents will be found in the history of that country. To illustrate the spirit in which he acted, a single fact will suffice. In July, 1566, soon after receiving with flattery Count Egmont, who had been despatched to lay before him the grievances of the Netherlands, alarmed at the gathering storm excited by his habitual violation of the laws and constitution of the country, he sent to his sister Margaret, the regent, a despatch consenting to the abolition of the Inquisition on condition that the bishops should be invested with inquisitorial power, and some other concessions of a like nature. At the same time he protested before a notary that these concessions had been extorted by force. A wilder extravagance was committed by him in 1568,

when he publicly confirmed (26th February) a decree of the holy office (16th February) sentencing all the inhabitants of the Netherlands to death. The excellent Emperor Maximilian sent him this year (2d March) a holograph letter protesting against his cruelties to the Netherlands, who were entitled to the protection of the empire. Philip replied that his love of justice had made him too slow in suppressing revolt, and that his conduct would finally be approved of by every one. His enmity to England was excited both by religious zeal and by the support given by Elizabeth and the English people to his revolted subjects in the Netherlands. Among the measures which he deemed it commendable to pursue for the gratification of this and other passions, as well as in pursuit of religious and political objects, was assassination. In 1571 he entered into the plot of an Italian, Ridolfi, to assassinate Elizabeth. In this he was so far excusable that Ridolfi was recommended to him for this purpose by Pope Pius V.; but the matter was not skilfully handled, for Alva, to whom Philip intrusted it, sent two assassins into England after the discovery of the plot. Philip was at this time openly courting the alliance of Elizabeth. On Oct. 7, 1571, his half-brother the Archduke John won the battle of Lepanto for the Holy League against the Turks, into which Philip had entered with the pope, and the Republic of Venice. The first project of the league was negotiated in this year between Philip and the Duke of Guise. He received the news of the St. Bartholomew massacre with sincere and malignant joy, viewing it at once as an error in the policy of his rivals and a wholesale destruction of his enemies. In 1573 Philip's religious zeal underwent a temporary abatement. He saw a prospect of succeeding to the German Empire on the death of Maximilian, and he engaged if he should do so to recognize the privileges of the Netherlands, and reinstate the Prince of Orange and his 'accomplices' in their possessions. In 1579, on the advice of Granvella, he proscribed William, putting a price of 25,000 gold crowns on his head. In April, 1581, Philip succeeded to the crown of Portugal, with its splendid eastern possessions, and he spent the two following years in that country. About this time he found political motives for intriguing with the Huguenots in France, and twice in 1582 made offers of assistance to the King of Navarre. In 1584 he renewed his alliance with the league, in order to oppose the succession of Henry to the crown of France. In 1586 Philip declared war with England. The year 1588 saw the destruction of the Armada and the descent of Spain from her position as a first-class power in Europe. In 1589 Philip missed, by his overweening self-conceit, an opportunity of making himself master of France. The States-general assembled by Mayenne proposed to recognize the Infanta Isabella Clara Eugenia as heiress of the French crown; but Philip refused to marry her to a French prince, and when he conceded this point declined to name her husband. Philip carried on his opposition by intrigues and warfare against Henry IV. for some years, but in 1598 the Peace of Vermins was concluded with France. He showed some disposition at the same time to make peace with England and the Netherlands, but his offers were not accepted, and he died without recognizing the independence of the latter country or being reconciled to the former. During his last years he suffered from diseases brought on by debauchery, which took a revolting form, his body being covered with vermin, which the skill of his physicians was unable to destroy. He died at the Escorial, 13th September, 1598. Before his death he had bestowed the sovereignty of the Spanish Netherlands on his daughter Isabella, subject to the

crown of Spain; and he was succeeded in Spain by Philip III., his son by Anne of Austria, his fourth wife.

Philip's character had some points in resemblance with that of James II. of Britain. He succeeded in disintegrating a great empire by means very similar to those which lost James his crown. He sometimes bent his views to policy, but his schemes of intolerance were never forgotten or left long in the background. His influence on Spain was very disastrous. The spirit of the people was crushed by intolerance and tyranny, and it may be said that even to this day Spain is suffering from the oppression of Philip II. The Netherlands were more fortunate, and Europe owes him the foundation of the Dutch Republic. His licentious amours occasioned one disgraceful murder, besides the assassinations he was continually plotting. He gave Antonio Perez written instructions to assassinate Escovado, the secretary of the Archduke John, and when he had accomplished the deed compelled him by threats of prosecution to give up the document. He left to his children the whip with which he and his father had scourged themselves, with as little benefit in his case, it would appear, to his moral conduct as the scourge he applied to his subjects had on their material prosperity.

PHILIP V., King of Spain, was the first Spanish king of the Bourbon dynasty. He was the grandson of Louis XIV. of France and second son of the Dauphin. He had by birth the title of Duke of Anjou. Philip was born at Versailles in 1683. He succeeded to the crown of Spain by the will of Charles II., who died without direct heirs, as the grandson of Charles's elder sister. On the death of Charles in November, 1700, he was immediately proclaimed king, and was generally recognized in Spain, Naples, and the Netherlands, but the succession had long been a matter of European alliances, and soon became the occasion of a European war, in which Philip was sustained only by France and the minor powers dependent on her, while one of his competitors for the crown, the Archduke Charles, second son of the emperor, and who afterwards succeeded to the empire, was supported by the whole weight of one of those great coalitions formed to check the ambition of Louis XIV., the second Grand Alliance, in which England, Holland, the Empire, most of the German states, and afterwards Portugal, took part. He married in 1701 Maria Louisa Gabriella, second daughter of the Duke of Savoy. Notwithstanding the splendid successes of Eugene and Marlborough, the great commanders of the alliance, the revolt of Aragon, and the temporary successes of Peterborough and Galway in Spain, the kingdom was secured for Philip chiefly by the victory of Almanza won by the Duke of Berwick 25th April, 1707, and he was confirmed in possession of it on renouncing his claim to the crown of France by the treaties of Utrecht in 1713 and of Rastadt in 1714. It was during this war, however, that Gibraltar was lost to Spain, Minorca was also ceded to England, Sicily to Savoy, the Netherlands, Naples, and the Milanese to Austria. Philip's wife died in February, 1714, and the Princess des Ursins, whom she had brought with her from Savoy, and who enjoyed the position of first favourite, persuaded Philip to marry Elizabeth Farnese, niece of the reigning Duke of Parma. In this the princess had miscalculated. The marriage took place in September, and she was immediately deposed from her position by the influence of the new queen. The confidence of Philip was now given to Cardinal Alberoni, the minister of the Duke of Parma in Spain. Philip was pious and uxorious, and the estimate formed of his character by his new minister

was that a wife and a hassock were all that the King of Spain needed. Alberoni accordingly prepared to govern Spain. Peace was for a time essential to his views, but it was only as a means of accomplishing ambitious projects. As Philip had a son by the first wife the children of Elizabeth could not succeed to the crown of Spain. Elizabeth wished to provide for them in Italy, and even coveted the reversion of the crown of France. These pretensions formed the basis of Alberoni's schemes, who proposed to raise Spain to the predominance in Europe which she had lost since the time of the Emperor Charles V. (See ALBERONI.) These schemes of Alberoni alienated France and led to the Triple Alliance formed in 1717 by Great Britain, France, and Holland against Spain, and which, after some temporary successes of the Spaniards (conquest of Sardinia, August, 1717), was merged by the accession of Austria into the Quadruple Alliance (August, 1718). The invasion of Spain by the Duke of Berwick compelled Philip to accede to the terms of the alliance. Spain ceded her conquests, but secured the reversion of Parma and Tuscany to the children of the queen, and Alberoni was dismissed. This was followed by intermarriages between the royal families of France and Spain. The Prince of Asturias, heir of Spain, and Don Carlos, heir of Tuscany and Parma, were affianced to two daughters of the Regent Orleans, and the Infanta to Louis XV. Philip, who was a prey to religious melancholy, and through the Jesuits, by whom he was governed, as great a persecutor as Philip II., now took a step attributed by some to hypochondria, by others to policy. He resigned the crown of Spain in favour of his son Don Louis (January, 1724), with a view, according to the latter explanation, to secure the reversion of the crown of France in the event of the death of Louis XV., whose health was then in a declining state. But the Prince of Asturias died in the following August, and Philip resumed his crown. In the following year the Infanta was sent back to Spain on the pretext of her being too young for Louis, an affront which nearly provoked a war with France and induced a closer alliance between Philip and the emperor. Philip guaranteed the Pragmatic Sanction and entered into various stipulations offensive to England as well as to France, as the restoration of the Stuarts by force of arms. The queen, however, finding that the alliance of Austria did not forward her views in Italy, brought about a reconciliation with England by the Treaty of Seville, 8th November, 1729, which guaranteed the succession of the Italian duchies to Don Carlos. A similar engagement was entered into by the emperor by the second Treaty of Vienna, March, 1731, but the war of the Polish Succession followed, and Italy was invaded by a Franco-Spanish army under Don Carlos. In this war Spain was deserted by France, by whom it was begun. Peace was concluded in 1736, and after protracted negotiations the third Treaty of Vienna was signed, 18th November, 1738, in which Naples and Sicily were assigned to Don Carlos in place of Tuscany, which was ceded to the son-in-law of the emperor. Mutual commercial grievances next led to a war with England, which was declared in November, 1739. This was followed by the death of Charles VI. (1740) and the war of the Austrian Succession, in which Philip took part with France and the enemies of Austria against England and her allies. He died before this war was concluded, 9th July, 1746, after a reign of forty-six years. Philip was constantly governed by favourites, and his constitutional melancholy at last completely incapacitated him for business. For the last ten years of his reign his chief favourite was an Italian singer, Farinelli (see FARINELLI), who had

charmed him with his voice. Notwithstanding this weakness and his religious bigotry, his love of justice and patriotic regard for the interests of his adopted country won the hearts of his subjects, and he died regretted. He patronized art and literature, and encouraged commerce. He or his ministers also improved the condition of the army and navy. He was succeeded by Ferdinand VI., his second son by Maria Louisa of Savoy.

PHILIP THE BOLD, Duke of Burgundy, born in 1342, was the fourth son of John, king of France. He fought at Poitiers (1356), where, according to Froissart, he acquired the surname of the Bold. He shared his father's captivity in England, and on his return his father, whose favourite he was, made him Duke of Touraine, and after the death of Philippe de Rouvre (1361) he restored for him the Duchy of Burgundy, which he had united irrevocably to the crown, and made him premier peer of France. The restoration of this powerful fief, the source of many future calamities to France, was confirmed by Charles V. on his accession to the crown, when Philip resigned the Duchy of Touraine. Philip married in 1369 Margaret, daughter of Louis, count of Flanders, which gave him on the death of his father-in-law (1384) the counties of Flanders, Artois, Rethel, and Nevers, and made him one of the most powerful sovereigns of Europe. During the reign of Charles V. Philip served against the English with ability and success in several campaigns in Beauce and Burgundy (1364), before Calais (1369), in Poitou (1372), and Flanders (1377). On the death of Charles (1380) he shared the administration of the kingdom with his brothers the Dukes of Anjou and Berry, and when the former, who claimed the regency by right of birth, left for Naples in 1382, the chief burden fell on him. The administration was not creditable to the brothers. Each of them concerned himself with his own hereditary dominions, and the revenues of the kingdom were wasted on their schemes of private aggrandizement. Notions of liberty were at this time beginning to be widely diffused in the cities, and the insurrectionary movements, excited by excessive taxation and other acts of oppression, were put down with a ruthless hand. In 1382 Philip assisted his father-in-law against his revolted Flemish subjects, who sustained a crushing defeat at Rosebeque (27th November). In 1385 immense preparations were made and vast sums uselessly expended in preparing for an invasion of England which never took place. The number of vessels collected, according to Froissart, would have sufficed to form a bridge from Calais to Dover. An expedition against the Duke of Gueldres, an ally of England, in 1388, was similarly costly and unproductive. The alliance of the Flemish democrats with England gave Philip a double motive for his hostility to that country. His administration in Flanders appears to have been wise and conciliatory. In 1388 the king took upon himself the administration of the kingdom. In 1392 he showed signs of insanity, and his uncles resumed the regency. The ministers of the king, who had been chosen from among the commonalty, the *Marmousets*, as they were called by the party of the great nobles, were banished. There were assassinations and deeds of violence between the parties, but nothing of this kind seems to be charged to Philip. He retained the regency till his death in 1404, though opposed by his nephew the Duke of Orleans, who was afterwards assassinated by his son Jean Sans Peur.

PHILIP THE GOOD, Duke of Burgundy, son of Jean Sans Peur, was born at Dijon in 1396. His father was assassinated in 1419 by the partisans of the Dauphin, afterwards Charles VII., and Philip, who had been brought up at a distance from the

scenes of contention in France, was called to succeed him. He immediately entered into the Treaty of Arras, by which he recognized Henry V. as successor to the crown of France. Charles VI. himself, guided by his queen Isabeau, concluded with him the Treaty of Troyes (1420), which was accepted by the states-general and the parliament, excluding the Dauphin from the succession and recognizing Henry as administrator of the kingdom and heir to the crown. Henry V. and Charles VI. died in 1422, and Henry VI. was proclaimed King of France. Bedford, who now became regent of France, married Philip's sister. The English, however, soon began to carry things with too high a hand, and finally alienated the Duke of Burgundy. Gloucester, regent of England, married the Countess of Hainault, and provoked a private war with Philip by taking forcible possession of her heritage. After bringing about a conference at Arras (1435), at which he failed to reconcile the two parties, Burgundy made his peace with Charles, who repudiated the murder of his father, recognized his independence, ceded to him some territories, and made a defensive alliance with him. Philip afterwards declared war on England, but soon made peace for his own states, and endeavoured, though in vain, to negotiate a peace for France. He ransomed the Duke of Orleans, who had been a prisoner for twenty-five years in England, and gave him his niece in marriage. He received the Dauphin Louis (see LOUIS XI.) at his court, when he quarrelled with his father (1456), but refused to assist him further than by his mediation. He gave him, however, a pension of 6000 louis and a residence in the Castle of Genappe. Charles remarked that he had received a fox who would devour his poultry. Philip accompanied Louis to his coronation (1461), where he displayed a magnificence which was in accordance with his tastes. Louis took advantage of his extravagance to purchase from him in 1463 the towns of the Somme ceded by his father as the price of the alliance of the Duke of Burgundy. Philip's son, Charles, count of Charolais, who had also quarrelled with his father and been reconciled, was offended at this concession, which Louis had used all his arts to draw from his father, and entered with other disaffected nobles into the League of Public Good (1465). Philip had by this time fallen into a state of mental incapacity, and the affairs of his dominions were managed till his death in 1467 by his son, who then succeeded him. Philip was dissolute in his manners as well as profuse and ostentatious in his tastes. He left numerous natural children.

PHILIPP I. (THE MAGNANIMOUS), Landgrave of Hesse, was born in 1504 near a town of the Palatinate called Caub, which the Hessians under William his father were then besieging. After the death of his father in 1509 he lived under the guardianship of his mother, and in 1518, on attaining his fourteenth year, assumed the reins of government. He vanquished Franz von Sickingen in 1523, and joined the princes who went out in 1525 to quell the insurrection of the peasants. This was effected by the battle of Frankenhausen; and the landgrave, befriended by John, elector of Saxony, was gained to the cause of the Reformation. The same year he issued his edict on the preaching of the gospel and the morality of the clergy, and to aid the success of the new doctrine, and secure its followers from hostile attacks, his spirited counsels led to the League of Torgau, formed between him and the Elector of Saxony in 1526. After this he attended the Diet of Spire, and spoke out strongly and firmly for the rights of the Lutheran Church. After his return he began the Reformation on an extensive scale. The monks were expelled from the monasteries, and their revenues were confiscated

and devoted to secular and useful purposes. In 1527 he founded the University of Marburg. He was driven into warlike measures by his zeal, inflamed by the information of Otto von Pack that the Catholic princes had concluded a league for the suppression of the Reformation. In these circumstances he subscribed the protestation to the Diet of Spire in 1529, submitted the Confession of Faith at Augsburg in 1530, and neither the personal representations of the emperor nor the political advantages offered to him could make him unfaithful to a cause whose blessings to humanity lay unfolded in all their magnitude before his mental vision. In the highest indignation he quitted the diet with his numerous warlike followers, and after forming an alliance for six years with the cantons of Zürich, Basel, and Strasburg with reference to attacks on religion, attended the conference of the Elector of Saxony, the Marquises of Anhalt and Brandenburg, and the Count of Mansfeld at Schmalkalden, and was, with the Elector of Saxony, in 1531, head of the Schmalkald League. In 1542 he fought victoriously against Duke Henry the younger of Brunswick, but was obliged to submit to the Emperor Charles V. after the battle of Muhlberg (1547). On this occasion he confided in the favourable mediation of his son-in-law Maurice, duke of Saxony, but, contrary to the true meaning of the capitulation, was detained a prisoner by the emperor, was obliged to give up his artillery, and pay a fine of 150,000 florins. In 1552, by means of the Passau Treaty, he obtained his freedom. After his return to his dominions he sent a body of auxiliaries to assist the French Huguenots. He afterwards laboured diligently to govern on popular principles, divided his possessions among his four sons, and died in 1567. With the consent of his wife, Christina, who lived till 1549, and after he had obtained the consent of Luther and Melancthon, he in 1540 married Margaret of Saale, usually called the *left landgrävine*, and had by her six sons and a daughter. He was equally magnanimous and courageous, well-informed and active, but displayed little statesmanship in his measures. See Rommel, *Philipp der Grossmuthige Landgraf von Hessen*, nebst einem Urkundenbuche (three vols. Giessen, 1830).

PHILIPPEVILLE, a city of Algeria, in the province and 39½ miles N.N.E. of Constantine, near the ruins of the ancient Rusucada, at the head of the Bay of Stora. It is fortified and well laid out, has several spacious squares and fine streets, a citadel, a Protestant church, a commercial college, a museum, a chamber of commerce, and a brisk trade. Pop. (1896), 13,311.

PHILIPPI, a city of Macedonia, in Thracia, founded by Philip of Macedon, who captured the site from the Thasians, and colonized it about B.C. 356. The previous settlement was called Crenides, from the numerous springs which rise in the locality. Its chief advantage lay in its command of a district rich in gold mines, which Philip caused to be worked to great advantage. The two battles fought in B.C. 42, which resulted in the overthrow of Brutus and Cassius by Antony and Octavius, were fought here. Philippi was visited on several occasions by the apostle Paul, who addressed to it one of his epistles. (See PHILIPPIANS.) The ruins of Philippi still exist.

PHILIPPIANS, EPISTLE OF PAUL TO, is supposed to have been written from Rome towards the close of St. Paul's first imprisonment there, about A.D. 63. Some authorities suppose it to have been written in Caesarea. (See PHILEMON.) The Philippians addressed in it (see preceding article) were Paul's first converts in Europe. The epistle is referred to, though not quoted, in the epistle of Polycarp, and by Tertullian and other early fathers. It appears to

have been written primarily to acknowledge the zeal of the Philippians in sending to minister unto him in his imprisonment. Epaphroditus, who conveyed it, was the messenger of the Philippians to Paul, and had been ill at Rome, which had been a cause of anxiety to the Philippians. Paul, therefore, hastened his return, and sent this epistle by him. It gives an account of the apostle's views and feelings on the subject of his imprisonment, and in contemplation of his approaching trial. It is full of exulting faith, and contains many exhortations based on the example of Christ and the doctrines of Christianity, but none of those systematic and argumentative statements of doctrine which are to be found in the other epistles of Paul.

PHILIPPICS, the three orations of Demosthenes against Philip, king of Macedon. (See DEMOSTHENES.) This name was also applied to Cicero's fourteen speeches against Antony, and it has hence come to signify an invective in general.

PHILIPPINES, or PHILIPPINE ISLANDS, an archipelago in the Pacific Ocean, lying north-east of Borneo, having on the west the China Sea, on the east the North Pacific, and on the south the Sea of Celebes; lat. 5° 32' to 19° 38' N.; lon. 117° 21' to 126° 8' E. It consists of forty islands of considerable size, and many smaller; area 114,325 sq. miles. Of the former the chief are Luzon, Mindoro, Samar, Panay, Leyte, Zebu, Negros, Bohol, Mindanao, and Palawan. The shore lines and internal surface of the larger islands are extremely rugged and irregular. Their magnificent mountain ranges are clothed with a gigantic and ever-teeming vegetation; and between these lie extensive slopes and plains of the richest tropical fertility, watered by numerous lakes and rivers, which afford abundant means of irrigation and transport. On the western parts it rains from June to September, but in October a change of wind transfers the rains to the eastern parts. These rains are so intense as to make vast lakes of the low grounds, and to render the highways impassable. The heats are tempered by perpetual moisture, and by the alternations of the land and sea breeze. The climate on the whole is healthy. Earthquakes are frequent, and often very destructive.

Metalliferous mountains everywhere occur. Gold is procured in the sand of the rivers. Ironstone is found yielding eighty per cent of iron; and rich specimens of copper attest its presence. Among the numerous volcanoes, extinct or active, abundance of sulphur is found. Coal exists in some spots, but is not worked to any extent. There are vast deposits of limestone and marble, and Negros produces magnesia and alum.

The mountains are covered with gigantic timber. Among plants cultivated for use are the abaca or Manila hemp, the pine-apple, the gounmuti-palm for their filaments; the cocoa, and other palms; the cotton, coffee, and cacao-tree; the sugar cane, indigo, tobacco, and the tamarind. Cassia, cloves, the wild nutmeg, and the red and black pepper vines, are found in Mindanao. Rice is raised in large quantities, both for home consumption and export. To these add maize, wheat, yams, the sweet-potato, and a great variety of delicious fruits, oranges, lemons, &c.

The buffalo is employed in tillage, and as a beast of burden. Both it and the ox are found in a wild as well as domesticated state. The Philippines produce small but spirited horses, deer, hogs, goats, and sheep; two civets and a wild cat; a monkey, a lemur, and a flying lemur; several squirrels, one of them a flying species; many bats, &c. The birds include many parrots and cockatoos, pigeons, the mound-bird, jungle-fowl, eagles, pelicans, herons, wild ducks, &c. On the shores are found the cave-

swallows, whose nests are so prized by the Chinese as food. The lakes and rivers teem with crocodiles and fish. Fish also, besides crustaceans, are found in great variety in the seas; and there is no lack of serpents, lizards, leeches, and insects.

The ethnology of the Philippine Islands is very complicated, but the careful researches of several travellers, notably Blumentritt and Montano, have made its main outlines fairly clear. The aborigines are represented by the Negritos of the remoter interior districts of Luzon, Mindoro, Negros, Panay, and Mindanao, a dark, woolly-haired, short, negro-like people with flattened noses, dilated nostrils, small chest, and calfless legs. Blumentritt estimated their numbers at 20,000, but the pure race is rapidly dying out. These aboriginal inhabitants are supposed to have been driven to the mountains of the interior at a very early period by invaders of Malayan stock. Both the authorities mentioned above distinguish between two invasions, the earlier invaders being named Indonesians by Montano. These Indonesians, after driving the Negritos inland, were themselves driven from the coasts by the Malays who arrived later. To these elements were added in historic times the Chinese and the Spanish, and from the blending of Negritos with Indonesians, Indonesians with Malays, Malays with Europeans and Chinese, &c., many intermediate types have originated. The true Malays are represented by many tribes speaking different languages, the two most important being the Tagals, occupying most of Luzon and the whole of Mindoro and Marinduque; and the Bisayans, who inhabit the islands between Luzon and Mindanao together with the northern part of the latter. The Bicolos, Ilocanos, Pampangos, Busaos, and Cagayanos are other important Malay tribes; and besides these there are the Mohammedan Malays of the Sulu Islands, Palawan, and Mindanao. There are very many Indonesian tribes, including the Ygarrotes, Samals, Tinguianes, Mandayas, Bagobos, &c. The pure Chinese inhabitants probably number fully 50,000, and constitute a large proportion of the shopkeepers and merchants. The number of Spaniards is about 15,000, mostly, except the priests, in Manila. The Spanish government forbade the public exercise of any religion other than the Roman Catholic. The head of the Roman Catholic church in the islands is the Archbishop of Manila, and under him are four bishops.

The textile productions of the Philippines are considerable in number, ranging from the delicate and costly *piña* muslins, made from the pine-apple fibre, and *sinamays* made from it and the abaca filament, to coarse cottons, sacking, and the beautiful mats made of the abaca and gommuti-palm fibres. Hats and cordage are manufactured to a considerable extent, and large numbers of well-known cigars. European art is successfully imitated by the natives in ship-building and coach-building, in the dressing and varnishing of leather, and in the manufacture of cordage. Buffaloes largely take the place of horses in the islands. An extensive trade is carried on in exporting Manila hemp, sugar, tobacco, cigars, indigo, coffee, birds'-nests, trepang, sapan-wood, dye-woods, frozen meat, mother-of-pearl, gold-dust, &c., and in importing manufactured cotton goods, wines and liquors, porcelain, cutlery, metals, drugs, &c. The exports amount to about £4,000,000, a large proportion of them going to Britain. The imports are valued at over £2,000,000.

Under Spanish rule the Philippines were divided into four governments, which were again subdivided into fifty-three provinces, each in turn comprising various *pueblos* or cantons. The supreme civil and

military government was in the hands of a governor-general, appointed by the crown. Besides being commander-in-chief of the land and sea forces, he was president of the supreme court of justice, &c. He was assisted by ministers and *juntas*, with whom he might advise, or to whom he might delegate his powers. An alcalde-mayor, or corregidor, was appointed by the crown for each of the provinces, as administrative, judicial, and fiscal officer. Each *pueblo* was under a native *gobernadorcillo* or mayor, popularly elected, and these again were assisted by inferior officers, chosen also from lists presented by the inhabitants. The Chinese and Chinese half-castes were allowed magistrates of their own. Both army and marine consisted almost entirely of natives.

History.—The Philippines were discovered by Magellan in 1521, and on the island of Mactan, near Zebu, he was killed on April 27th of that year while fighting against a native tribe. Magellan named the islands after St. Lazarus, because he had discovered them on the day of that saint. Twenty-one years afterwards the Spanish navigator, Lopez de Villalobos, gave them their present name (Spanish, *Islas Filipinas*) in honour of Philip II. of Spain. During the six years following 1565 the islands were conquered for Spain by a small force under Miguel Lopez de Legaspi, and both in the conquest and the subsequent work of government Roman Catholic priests played an important part. Manila was founded in 1571. At various subsequent times Portugal and Holland tried to obtain possession of this valuable archipelago, but their efforts were unsuccessful. In 1762 an English expedition captured Manila, but a payment of £200,000 secured the departure of the invaders. In 1898, during the Spanish-American war, a squadron of United States ships under Admiral Dewey destroyed the Spanish fleet in Manila harbour and captured the forts at Cavite. On Aug. 13th Manila itself was captured with the aid of the insurgents under Aguinaldo. The islands were ceded by Spain to the United States, but Aguinaldo and his followers proclaimed a Filipino Republic, and refused to recognize the cession. Fighting of a somewhat indecisive character ensued between the American troops and the Filipinos, and although the latter have been several times defeated they have not yet (1902) been subdued. Pop. estimated at 8,000,000.

PHILIPPONES, a Russian sect, a branch of the Roskolnicians, so called from their founder, Philip Pustoswiät. The sect took its rise towards the end of the seventeenth century. They differ from the other Roskolnicians chiefly in having no ordained clergy, but only elders.

PHILIPPOPOLIS, or FILIBI, a town of Bulgaria (Eastern Roumelia), on the navigable river Maritza, 86 miles W.N.W. of Adrianople. It stands on hills of syenite, and has mostly wooden houses. In 1818 it was almost totally destroyed by an earthquake; but it has since recovered through its trade and manufactures. Pop. (1893), 36,033.

PHILIPPSBURG, a town of Baden, in the circle of Carlsruhe, on the right bank of the Rhine, in a marshy and unhealthy district, 16 miles north of Carlsruhe. Philippsburg was formerly a celebrated imperial fortress, and up to 1803 belonged to the bishopric of Spire. It was fortified by Philip, bishop of Spire, in 1618 and 1623, who had chosen it for his residence, and changed its name from Udenheim. In the Thirty Years' war it fell successively into the hands of the Swedes, the French, the imperial forces, and again of the French. In the wars between Louis XIV. and Germany it was taken by the Germans in 1676, was assigned to them by the Peace of Nijmegen in 1679, was taken by the French again in 1688, but restored by the Peace of Ryswick in 1697.

In 1734 the French retook it with little trouble, but with the loss of the Duke of Berwick. In 1800 its fortifications were demolished after it had been bombarded and taken by the French. Pop. (1895), 2467.

PHILIPS, AMBROSE, a poet and dramatic writer, of a Leicestershire family, was born about 1675, and studied at St. John's College, Cambridge, and became a fellow. On quitting the university he went to London, and became one of the literary wits who frequented Burton's coffee-house, and a friend of Steele and Addison. The publication of his *Pastorals* (1709) involved him in a war with Pope, who ridiculed them in the *Guardian*, *Martinus Scriblerus*, &c. He was one of the writers of a periodical paper called the *Freethinker*, started by himself in 1718; and Dr. Boulter, one of his colleagues, obtaining preferment in Ireland, Philips went with him, and in 1733 was made judge of the prerogative court at Dublin. He returned to England in 1748, and died the next year. He was the author of the *Distrest Mother*, a tragedy (1712), taken from Racine; the *Briton* (1722), and *Humphrey*, Duke of Gloucester (1723), both tragedies. He also wrote a number of short-lived poems, which gave rise to the epithet of *numby-pumby*, a play on his name.

PHILIPS, JOHN, an English poet, born in Oxfordshire, 1676, was educated at Christchurch, Oxford, where he produced the *Splendid Shilling*, in which the sonorous cadence of the blank verse of Milton is adapted to familiar and ludicrous topics. He also wrote *Blenheim*, a poem in celebration of the Duke of Marlborough's victory; and *Cyder*, a work in imitation of Virgil's *Georgics*. He died in 1708. He imitates Milton's style in all his poems.

PHILISTINES, a people of Palestine, who gave their name to the whole country. (See PALESTINE.) Hardly anything is known of the history of the Philistines except from incidental notices of them in the Bible in connection with the history of the Jews, and little light seems to have been thrown on these notices by biblical critics, who are at variance on almost every point referred to in them. The name is commonly understood to mean wanderers or emigrants, although there are other interpretations. The origin of the Philistines is much disputed. It is referred to in Genesis x. 14, where their descent is given from Mizraim, son of Ham; Deuteronomy ii. 23; Jeremiah xlvii. 4; Amos ix. 7, and other passages. We have not space even to state the philological and other hypotheses founded on these passages, and can only mention that the two leading theories (which will be found discussed in Smith's and other Biblical Dictionaries) connect them with Crete or other northern locality or with Egypt, and that the former hypothesis seems to present the least insuperable difficulties. Movers, Von Lengerke, J. R. Beard, &c., advocated the former view. They are also identified with the Hycsos, who for a time held Egypt in subjection. The Philistines are first mentioned as a pastoral people living in Gerar in the time of Abraham, and with whom he made a covenant. By the time of the exodus they appear to have occupied the southern coast of Palestine, and to have become a powerful and commercial people. The first mention of them in Genesis is held, however, by many critics to be an interpolation, or to indicate only a pastoral people living in the country afterwards occupied by the Philistines. At the time of the invasion of Palestine by the Hebrews they possessed the whole of the Shephelah or low country along the coast from the river of Egypt to Ekron, and formed a confederacy of five leading cities—Gaza, Askelon, Ashdod, Gath, and Ekron, with their dependencies, under five lords. Their lands were divided among the Israelites, being appropriated to

Dan and Judah—not apparently because they were reckoned among the doomed Canaanitish nations, but because they had occupied the territory of one of them, the Avims; and their country was consequently part of the possession promised to Abraham. No attempt, however, was made to occupy it during the time of Joshua. The first intimation of any encroachment on it is in Judges i. 18, where Judah is said to have taken Gaza, Askelon, and Ekron, with the coasts thereof; but this verse is held to be inconsistent with Judges iii. 8, and if not an interpolation, the occupation to which it refers must have been very temporary. During the period of the Judges the Philistines appear to have taken advantage of the declining vigour of the Hebrew commonwealth, and the inability of the Israelites to defend themselves against the numerous hostile nations by whom they were surrounded to gain a complete ascendancy over them. With the exception of occasional but rare invasions from Egypt or Phœnicia, the Philistines themselves had no enemies but the Israelites to dread, and when left undisturbed by them, could prepare at leisure to take advantage of all their troubles and divisions. The neglect of the latter to complete the conquest of a territory thus sheltered by themselves, and forming an integral part of their own possessions, was thus a manifest breach of sound policy. In the time of Saul the ascendancy of the Philistines had, notwithstanding occasional defeats, become established. Instead of a regular tribute the Hebrews seem to have been subjected to the far more oppressive infliction of periodical predatory excursions, to whose devastations they were able to oppose no resistance. A superiority so manifested could not fail to kindle personal resentments when public spirit was too low to resist it, and the vindictive policy pursued by Samson was at once the natural result of the situation, and the best means of exciting the patriotic emulation of his depressed countrymen. The Philistine ascendancy seems to have been one of the chief motives that weighed with the Israelites in demanding a king to concentrate their force for defensive purposes, and the conquest of the Philistines was naturally one of the first objects of the Hebrew monarchy. This was accomplished partially under Saul and more completely under David, who carried the war into their own territories, so that in the reign of Solomon the Philistines were completely subdued and put under tribute, but they appear otherwise to have been left undisturbed under their own laws and organization. They consequently reappear as an independent state after the division of the Kingdom of Israel. Their power had evidently by this time been so far broken that they did not dare to attack the Kingdom of Judah, which from its immediate neighbourhood could have speedily brought the whole of its organized military force to bear against them; but they seem to have resumed their predatory habits at the expense of the Israelites, who were in a less favourable position for retaliating by a regular invasion. This may be gathered from the incidental notices of the sieges of Gibeon in the reigns of Nadab and Elah (1 Kings xv. 27; xvi. 15). In the first instance it is said that all Israel were encamped against Gibeon, and in the second that the people were encamped against it. In the midst of dynastic troubles the securing of this border stronghold seems to have been a national object, which is most easily explained by supposing that it was desired as a protection against predatory incursions. When the Jewish monarchy began to decline the Philistines waxed bolder. They invaded Jerusalem under Jehoram, and under Ahaz recovered some of their ancient possessions (2 Chron. xxviii. 18). They as well as the Jews suffered from the conten-

tions of the Egyptian and Assyrian monarchs, and their nationality became merged in the succession of empires which commanded the East from the time of Nebuchadnezzar. When the Jews recovered their independence under the Maccabees, they conquered the country of their ancient rivals, and it was subsequently annexed by Pompey to the province of Syria.

Of the language of the Philistines nothing is known. It has been conjectured to be Semitic from the names of their cities, but there is no proof that these names were bestowed by themselves. From one passage (Neh. xiii. 23) it appears that it differed from the language of the Jews. They worshipped Dagon, Ashtaroth, Baal-zelub, and Derceto, a deity half-woman and half-fish. They had temples to these deities in their principal cities, and were superstitiously credulous in their devotion to them. The Philistines appear to have had both a maritime trade and a share in the inland traffic carried on by caravans between Egypt and the countries to the north of them. Their country was remarkably productive, but their agricultural industry would probably be somewhat impaired both by their opportunities for commerce and the facility of reaping the harvests of the Hebrews.

PHILLIP, JOHN, R.A., painter, was born in Aberdeen, 19th April, 1817. He was the son of a working shoemaker, who had previously served in the army. He was educated till the age of eleven at the Lancasterian school, after which he was compelled to contribute to his maintenance by acting as errand-boy to a tinsmith. He here acquired the rudiments of his art by making pictures from his own imagination with the paint used by his master for painting pails and watering-cans. When he had attained the age of thirteen he received some instructions from a local portrait-painter, and began to acquire a certain celebrity by painting emblems for insignia to be used in trade processions. He also attempted a portrait of his grandmother. He next became an unindentured apprentice to a house-painter and glazier. Here he devoted to his master's work the most diligent of eye-service, applying himself zealously to the mixing of putty when his employer was present, and withdrawing from its hiding-place some concealed sketch, and working at it as zealously whenever his master's avocations took him elsewhere. During his apprenticeship he began to paint portraits for which he charged a guinea a pair (husband and wife). He afterwards at his own request was taken into the employment of a portrait-painter, James Forbes, where for the first time he had proper materials and regular instruction. His colouring already excited the admiration of his master. In 1834 he made a visit to London in a coasting-vessel to visit the Royal Academy's exhibition. On a subsequent visit he saw the paintings of Sir David Wilkie, which aroused his emulation to paint a Scottish interior—it was that of his father's house, a cobbler's kitchen. Another picture, the Packman's Visit, had an important influence on his future career. It was seen and admired by Mr. Fryse Gordon, a connoisseur and writer on painting, who discerned in it the promise of future eminence (for a different version of this story see the *Athenaeum*, 1867, vol. i. pages 328 and 357), took Phillip to his own house, and procured a tutor for him. Prosperity, however, had its drawbacks, and Phillip soon found he could have too much even of painting. His patron thought application was everything, and would have kept him at work from morning to night. Phillip, who found his genius crushed by this drudgery, rebelled. 'Does he think,' he said, 'that I can paint at no more expense of mind than it took to put the red

and green on the pails and roozers (watering-cans)!' Phillip twice attempted to escape from too much painting by going to sea. But he was won back, and his patron was not to be balked of his good intentions. He proposed raising a subscription among his friends for the young artist's education; but on applying to Lord Farnmore, that nobleman promptly took the burden upon himself, and contributed the pecuniary assistance needed with the greatest liberality. Phillip had begun to succeed in his profession, and was becoming independent through his own exertions, but by the kindness of his friends he was enabled to go to London in 1836. He was soon admitted a pupil of the Royal Academy. In 1838 and 1839 his portraits, by which he had begun to maintain himself, were admitted to the exhibitions of the Academy. In 1840 he returned to Aberdeen, where he resided for seven years, pursuing his profession as a portrait-painter, but not abandoning the study of ideal art. In 1840 he exhibited a picture in the Royal Academy, but it failed to attract much attention. He had several pictures the same year in other metropolitan exhibitions. In 1841 he exhibited four pictures at the Royal Scottish Academy's exhibition in Edinburgh. During each successive year he continued to send pictures to the exhibitions until, in 1847, he returned to London. This year he exhibited at the Academy a picture which began to lay the foundation of his fame, Presbyterian Catechizing. Though frequently dissatisfied with the position his pictures procured, he continued after this to send them regularly to the Academy. Drawing for the Militia (1849), Baptism in Scotland (1850), and the Free Kirk were among his most celebrated pictures at this period. In the autumn of 1851, his health beginning to fail, he went to Seville, where he spent seven or eight months. He visited Spain again in 1856-57, and in 1860-61, and Rome for about three months in 1866. During his first visit to Seville he bestowed special study on the works of Murillo and Velasquez, the latter of whom he especially admired. From this period a marked change in his style may be dated, and something of the rich colouring and brilliant treatment of the Spanish school are to be found in his subsequent works. He was introduced on his return by Sir Edwin Landseer to the queen, who ordered several pictures from his sketches. El Paseo, the Letter-writer of Seville, and the Spanish Contrabandistas were painted for the royal collection. Life among the Gipsies at Seville was exhibited at the Royal Academy in 1853, and at once commanded the admiration of critics. Numerous other pictures on Spanish subjects followed, together with a few portraits and Scotch pictures, among the best of which is Collecting the Offering in a Scotch Kirk. In 1858 he exhibited, besides the Contrabandista, Youth at Seville and the Daughters of the Alhambra; in 1859 The Huff, which procured his election as a member of the Royal Academy. His diploma work, Prayer, was exhibited the following year, along with the Marriage of the Princess Royal, painted for the queen. Among his pictures in 1863 were the House of Commons, 1860; and La Gloria, a Spanish wake. The Early Career of Murillo was exhibited in 1864, and a portrait of the Right Hon. Duncan MacNeill of Colonsay for the Parliament House, Edinburgh, in 1866. Two pictures illustrative of the Spanish lottery, The Purchase of the Tickets, and The Results of the Drawing, are said to have been the last from his easel. He died of paralysis, the result of a low fever, 27th February, 1867. The chief technical characteristics of Phillip's style as a painter may be said to be breadth of treatment and powerful colouring. In the last particular he was unsurpassed, and to these he added humour, pathos,

and a true appreciation of character. His flesh-tints are distinguished by their rich and healthy hue.

PHILLIPPS, SIR THOMAS, a famous collector of old manuscripts and books, was born in Manchester on July 2, 1792. From Rugby school he proceeded to University College, Oxford, where he graduated B.A. in 1815, and proceeded M.A. five years later. His taste for books and book-collecting was manifested even at school, and on succeeding to his father's Worcestershire estates in 1818 he made the purchase and study of old manuscripts and books the main business of his life. One of his first important acquisitions was the greater part of the Meerman collection of manuscripts sold at the Hague in 1821, and immediately afterwards he purchased another valuable series from Professor Van Ess of Darmstadt. Thenceforward he constantly added to his library manuscripts of every kind, many of them of the utmost value, until he had amassed no less than about sixty thousand. Incumbula and other valuable books were also bought up by him with avidity, and likewise coins and pictures. In 1822 he founded a printing-press on his Worcestershire estate of Middle Hill, and from it he issued some important publications, especially catalogues of manuscripts and somewhat similar works. He removed his library and press in 1862 to Thirlestane House, Cheltenham, where he died on Feb. 6, 1872. He was elected F.R.S. in 1819, and was created a baronet in 1821. J. O. Halliwell, the great Shakspearean, married his eldest daughter and succeeded to part of his estates, and in 1872 changed his name to Halliwell-Phillipps. Sir Thomas left Thirlestane House and its huge collections to his youngest daughter, but a considerable part of his manuscripts has now returned to the Continent, and the books have been sold by auction. He privately printed *Collections for Wiltshire* (Salisbury, 1819) and *Account of the Family of Sir Thomas Molyneux* (Evesham, 1820).

PHILLIPS, JOHN, geologist, was born in Wiltshire, 25th December, 1800. His parents died early, and he was left under the guardianship of his uncle, William Smith, the geologist. He attended school at Holt Spa, Wiltshire, for five years, and at the age of about seventeen returned to his uncle's house in London, and gave himself up to geology. In 1821 Phillips accompanied Smith to York, and soon after he was appointed keeper of the Yorkshire Museum, and secretary of the Yorkshire Philosophical Society. He also lectured on geology in most of the Yorkshire towns, as well as elsewhere, and when the British Association was formed in 1831, his operations had extended to University College, London. He took a leading part in the formation of the British Association, and in 1834 he was appointed professor of geology in King's College, London, and in 1844 in the University of Dublin. In 1853 he was appointed deputy reader in geology at Oxford, and received the degree of M.A. On the death of Buckland (1856) he received the appointment of reader, being subsequently constituted professor. He died at Oxford, 24th April, 1874. Phillips' works include a treatise on Geology in Lardner's *Encyclopædia*, treatise on Geology from the *Encyclopædia Britannica* (published separately in 1840); *Guide to Geology* (1834); *Memoirs of William Smith* (1844); *The Rivers, Mountains, and Sea Coast of Yorkshire* (1852); *Life on the Earth* (1861); *Notices of Rocks and Fossils in the University Museum, London* (1863), &c.

PHILLIPS, THOMAS, painter, chiefly of portraits, was born at Dudley on Oct. 18, 1770. He received a good general education, and began his special art training under a Birmingham glass-painter. Proceeding to London in 1790, he made the acquaint-

ance of Benjamin West, who found him employment on the windows of St. George's Chapel, Windsor. He entered the schools of the Royal Academy in 1791, and was represented in the exhibition of the following year by a View of Windsor Castle, and in those of the immediately succeeding years by the Death of Talbot, Earl of Shrewsbury, at the Battle of Châtillon (1793); Ruth and her Mother-in-Law (1793); Cupid Disarmed by Euphrosyne (1794); Elijah returning the recovered Child to the Widow (1794); and Portrait of a Young Artist (1794). He then set up as a portrait painter, and in spite of the severe competition of men of established renown, such as Sir Thomas Lawrence, Hoppner, Shee, Owen, and Beechey, he soon came to the front, and in 1804 he was elected A.R.A. He became a full academician in 1808, when he presented *Venus and Adonis* as his diploma work. His portraits include the following:—Prince of Wales (1806); Lord Thurlow (1806); William Blake (1807), in the National Portrait Gallery, engraved by Luigi Schiavonetti, and etched by William Bell Scott; Sir Joseph Banks (1809), engraved by Niccolò Schiavonetti; Lord Byron (1814), engraved by Robert Graves; Sir Francis Chantrey (1818); the poet Crabbe (1819); Lord Brougham; Sir Walter Scott; Robert Southey; Samuel Taylor Coleridge; Thomas Campbell; Henry Hallam; Sir Edward Parry; Sir John Franklin; Major Denham, the traveller; Sir David Wilkie, one in the National Gallery, and another in the National Gallery of Scotland; Sir Humphry Davy; Samuel Rogers; Michael Faraday; John Dalton; a head of Napoleon I. (1802), painted by the connivance of the Empress Josephine; Sir Francis Burdett; and himself (1844). The Expulsion from Paradise also deserves mention. He succeeded Fuseli in 1825 in the professorship of painting at the Royal Academy, and after his resignation in 1832 he published a series of Lectures on the History and Principles of Painting (1833). He died in London on April 20, 1845. He was one of the founders of the Artists' General Benevolent Institution. His son Henry Wyndham Phillips was also a portrait painter. He was born in 1820 in London, studied art under his father, began to exhibit at the Academy in 1838, was long secretary of the Artists' General Benevolent Institution, and died at Sydenham on Dec. 8, 1868. His chief portraits are those of Sir H. A. Layard (engraved by S. W. Reynolds), Charles Keim as Louis XI., Dr. William Prout, Robert Stephenson, and N. W. Senior.

PHILOCTETES, a Grecian hero, celebrated for his skill in archery. He led a body of warriors in the expedition against Troy; but having been bitten in the foot by a serpent while on the way thither he became, by the mortification of his wound, so offensive that he was left behind in Lemnos, and there dragged out nine miserable years while the war proceeded. But, according to an oracle, Troy could not be taken without the arrows of Hercules, and these were in possession of Philoctetes, to whom the hero had given them when he ascended his funeral pile. It therefore became necessary for the Greeks before Troy to send for Philoctetes, who was prevailed on to proceed to Troy. He was cured by Machaon (or Podalirius), and after many Trojans, among whom was Paris, had fallen by his arrows, the city was taken. The history of Philoctetes forms the subject of one of the tragedies of Sophocles. In the Homeric poems all that is told of Philoctetes is his being left at Lemnos in consequence of his wound, and returning home in safety.

PHILO JUDÆUS, a Jewish philosopher who flourished at Alexandria in the first century of the Christian era. He went to Rome in A.D. 40 as one

of a deputation from the Jews of Alexandria to the Emperor Caligula, to persuade him to revoke the decree by which he compelled the Jews to pay divine honours to his statue. He was the oldest of five deputies. This and the fact that he visited Jerusalem, that he belonged to a wealthy family, and received a liberal education, is nearly all that is known of his life. He left many Greek writings still extant which mostly have reference to the books of Moses (the Pentateuch). They comprise an account of the Mosaic narrative of the creation, an extensive series of treatises forming together an allegorical exposition of Genesis ii.-iv., lives of Abraham, Joseph, and Moses, treatises on the Decalogue and the whole system of Jewish law, &c.

Before the time of Philo the hellenized Jews (see HELLENISTS), particularly those of Alexandria, had begun to blend the ideas of the Greek philosophers with the teaching of their own sacred books; but as they generally held that the Pentateuch itself was the source of inspiration from which the Greeks derived what was true in their philosophy, they endeavoured to arrive at similar conclusions by allegorical interpretations of their own books, finding 'indications of the profoundest doctrines of philosophy in the simplest stories of the Pentateuch'. It was in this Alexandrian school of hellenized Judaism that Philo was brought up. He did not even know the Hebrew Scriptures except through the Septuagint version. His philosophy was thus strictly a theosophy. It rested, as its direct foundation, on the Jewish Scriptures as an inspired revelation, and with these it incorporated the speculations of the writer, founded on the systems of Greek philosophy which best harmonized with the teaching of the Hebrew Scriptures, and especially on the philosophy of Plato. There is neither much depth of original speculation nor much logical consistency or scientific completeness of system in Philo. On the other hand, he was not deficient in constructive power, and his works form the best representative of the Græco-Jewish philosophy.

Philo's idea of God was partly religious, partly philosophical. From his faith as a Jew he derived the principle that God is to be worshipped as a personal being, but in developing his conception of God he is indebted chiefly to philosophical speculations. He held that God is incorporeal and only cognizable by reason. He is the most universal of beings, and higher than knowledge, goodness, or beauty, *per se*. He has, strictly speaking, no attributes, being pure, unqualified being: he is therefore incomprehensible. The attributes ascribed to God in Scripture are to be understood only figuratively. God is present everywhere in the material universe by his operations; nowhere in his essence. God is the only free being. All others are subject to necessity. Philo's notions of matter are not remarkably consistent. He held God to be too perfect to have any association with it, yet he holds him to be the Creator of the universe. Matter, which has only an apparent existence, is the cause of all evil, as opposing resistance to the arrangements of the Creator. In its primeval state it is passive, lifeless, and destitute of quality or form. Between God and the world there is an intermediate being, the Logos. Philo wavers in his account of the Logos also. The Logos is the most universal of all beings except God. Philo personifies the Logos, but not so consistently as to render it certain that a distinct person and not a mere emanation or assemblage of attributes is intended. Thus, he represents God as the source of light, the Logos as the nearest circle of light proceeding from it, and each separate power as a separate ray. The Logos contains in itself the sum of ideas—powers or spiritual forms which pervade the universe, and which are creative, govern-

ing, foreseeing, law-giving, &c. These forms are also regarded as either qualities of the deity or distinct persons. Sophia, wisdom, is sometimes considered as the first of the potencies of the Logos, sometimes as the mother of the Logos. God created the world, as already indicated, by the agencies of these potencies, or of the Logos in whom they reside, out of unqualified matter. He gives the Logos the titles of Son of God, Paraclete, and Mediator between God and Man. Philo added an element of mysticism to his Platonic speculations. He held the highest attainment of philosophy to be the intuition of God, which is attained through divine illumination by means of self-renunciation and resignation to the divine influence. Man is a dual being, having a soul that came from God, tied to a body that naturally tends to the things of sense; by the aid of God the soul may be lifted above the body and ultimately regain its original source.

In interpreting Scripture Philo recognizes a double sense, the allegorical, which is the higher and more important, and the literal, which is not to be neglected. The anthropomorphic representations of God in Scripture he regarded as an accommodation to the sensual nature of man. Even in history the allegorical sense is never wanting; thus, he divided the laws into unwritten laws, which are contained in living patterns, as Abraham, Isaac, Jacob, Moses, &c., and written laws, which are contained in particular precepts. It is a fundamental principle with him that the law, which emanates from the being who is both the creator and the father of the universe, is in harmony with nature, and that he who violates it is punished by natural events. He defended the outward observances of religion against those who would have reduced them to mere symbols. 'Although circumcision', he said, 'properly symbolizes the removal of all passion and sensuality and impious thoughts, yet we may not therefore set aside the practice enjoined; for in that case we should be obliged to give up the public worship of God in the temple, and a thousand other necessary solemnities.'

The whole of Philo's works are not extant: some treatises have latterly been recovered from palimpsests. Among editions of Philo's works are those of Thomas Mangey (London, 1742); A. P. Pfeiffer (Erlangen, 1820); C. E. Richter (Leipzig, 1828-30); the Tauchnitz edition, published at Leipzig, 1851-54; and that of Cohn and Wendland (vol. i., Berlin, 1896). See Dr. Drummond's *Philo Judæus* (two vols. 1888); Conybeare's *Philo about the Contemplative Life* (1895); Ryle's *Philo and Holy Scripture* (1895); Siegfried's *Philo von Alexandrien als Ausleger des Alten Testaments* (1875); and Herriot's *Philon le Juif* (1898). There is a translation in Bohn's *Ecclesiastical Library* (in four vols.).

PHILOLOGY, a term of Greek origin, formerly applied to the study of the intellectual development of any people, or more especially of their language and literature, now more commonly applied to the study or science of language in general, and as equivalent to linguistic science, *comparative philology* being also employed in much the same sense.

Language is the expression by articulate sounds of ideas which are to be communicated to one or more hearers. The definition is not absolutely accurate, for a considerable part of speech, if the seeming paradox be allowed, consists of silence. In the production of sounds like *p*, *b*, *t*, *d*, there is a moment of absolute silence, as can easily be proved by pronouncing them as *ip*, *ib*, *it*, *id*, the English names of the sounds concealing this fact as they end in a vowel. It is, moreover, to be noticed that language is not the only method by which ideas can be communicated from one person to another. A sigh, a blush,

a gesture may be more expressive than a multitude of words, and are intelligible over a far wider area than any single language. The Red Indians of America are reported to have possessed a gesture or sign language which was intelligible throughout the length and breadth of the continent, though the spoken dialect of a tribe often extended over only a small district.

Of the origins of speech we know nothing. From very early times speech has been recognized as the chief criterion whereby to distinguish man from the brutes. Yet, as elsewhere in nature, the hard-and-fast line is drawn only by man to suit the systems which he constructs; in nature itself clearly marked divisions are not conspicuous. Darwin observed in the case of the dog that the species which had associated with man, and had, so to speak, shared in his civilization, had developed several notes which are entirely wanting in the cry of the wild dog. It may be plausibly argued that the same is true of man; that he, possessing at first but a few incoherent and martillate cries to indicate pleasure or pain, amazement or fear, developed in process of time, as his needs and his skill in supplying them increased, a system of sounds which conveyed those impressions with more precision to his associates. Most animals, at any rate probably all gregarious animals, are able to impart to their comrades warning of impending danger, or to indicate the proximity of food. But so far as we can tell, man is the only animal which can communicate information to his fellows regarding the nature of the impending danger, or the kind of food which he has discovered.

It may safely be assumed that the number of vocables possessed by primitive man was comparatively small, corresponding to the comparative smallness of his needs. It has indeed often been alleged that tribes have been found whose vocabulary had to be eked out to such an extent by gesture that they could not carry on a conversation in the dark. None of these tales rests on satisfactory evidence or has been verified by other observers.

Besides the cries of pain, pleasure, and other feelings to which the first elements of language have been attributed, there is little doubt that a considerable number of sounds arose from imitation of animals' cries. Imitation may arise from two causes, from delight in mimicry or from the inspiration of necessity as an aid in the arts of hunting. It is no doubt true that many of the imitative (onomatopoeic) forms of modern languages are of comparatively recent origin; but we have no reason to believe that forces operating in recent times in language have not operated throughout the history of the race, while the necessity for these imitative sounds was, in primitive times, certainly more pressing. Moreover, whatever the natural gifts of the human being for the art of mimicry, it is certain that in the early years of childhood, after the first months of infancy are passed, imitation is the method by which most things are learnt.

A third possible source of language ought also to be mentioned. Children have often been observed in their play to invent a vocabulary for themselves, a great deal of which was composed of babbling sounds, without reference to the words of the language that they knew. Often words of this sort, or others which have been manufactured out of ordinary words metamorphosed by infantile talk beyond recognition, remain a part of the nursery vocabulary long after the speakers are perfectly competent to talk the language of their parents. The nursery language is not permanent because of the overpowering influence of the language current in the larger world outside; it would not, however, be unreasonable to assume

that primitive man, who was more like the infant in his development, and was not exposed to similar external influences, may have manufactured no small part of his vocabulary on the same principles.

It is this side of language which most closely approaches to singing. Some authorities, indeed, contend, and not without plausibility, that man might with equal propriety be defined as a singing animal. The difference between speech and song consists in the greater variety of pitch which prevails in the latter, and in the more rhythmic intervals between the sounds. It has been observed that the higher the civilization of a people the more monotonous is the pitch of its language. All languages, however, even though, like English, they may carry this monotony very far, nevertheless vary the pitch of individual words and syllables in the sentence. Some of the languages belonging to the same family as English, such as Swedish and Norwegian, retain a large number of tones which literary English has lost, though tones of the same sort may be heard in various English dialects. Some languages more remote than Swedish and Norwegian, but still of the same stock as English, recognized such tones as the important part of their accent system, and indicated them by special signs. This is a feature characteristic of Greek and of the earliest Sanskrit, and it has been satisfactorily demonstrated that these tones must have characterized the language, now lost—the so-called Parent Speech—from which all the languages of this stock have been derived. These musical tones play, indeed, a greater part in the conveyance of meaning even in modern times than is generally recognized.

One further problem in connection with the origin of language requires to be mentioned. This is the relation between speech and thought. As is well known the late Professor Max Müller held very emphatically that thought was impossible without speech, and conversely that speech was impossible without thought, the two being facets, as it were, of the same diamond. The first part of the theory was held strongly also by the German philosopher Noire. Noire's theory might be expressed in the words which, a generation earlier, Shelley applied to Prometheus:

'He gave man speech, and speech created thought,
Which is the measure of the universe'

But here it is necessary to distinguish. Here, as in the case of speech, the hard-and-fast line drawn between man and brute has little justification in the facts of nature. It is clear that many of the lower animals are able to perform the first and most important step in reasoning, which is, to draw a conclusion from premises. A dog has as definite a notion as a child, that if caught in mischief he will be punished. A dog that fetches the mother to rescue her child has undoubtedly a notion of how to find the appropriate means to achieve an end. Such action is not instinct. It has little or no bearing on the welfare of the dog, and is not the kind of action which is frequently needed and likely to recur from generation to generation. It is as much reason as a large part of the human race ever exercises. No doubt thought, in the sense of long trains of ratiocination, is impossible without language. But it is equally true that highly-developed thought, as in a problem where a great many steps appear in the solution, is equally impossible without writing. It is no less true that the higher forms of mathematical thought cannot be carried on without the help of the differential calculus. Calculus, writing, language, are all apparatus of the same kind; the difference between them is only of degree.

Language, which has come into being to the best of our belief as above described, it is the province of philology to investigate. As to the original form of the language spoken by the human race, or whether it originated in one centre or in many, we have no evidence. This is not to be wondered at. Anthropologists are not yet certain how long man has existed on this planet, but it is evident that he has existed long enough in widely-separated areas for all traces of original connection, if such there were, to disappear. Language is ever in a state of flux. Even when to some extent stereotyped by the existence of a literature it is continually changing. We have only to think of the tremendous changes which have taken place within the last thousand years in the English tongue—the tongue of a community with a continuous literature and uninterrupted political development—to realize how great in a short time the changes might easily be in a small community loosely held together and without either literature or stable political institutions. All communities, great and small, are dependent for their existence on their food-supply. The great communities organize for themselves a continuous supply of food. Primitive communities, unable to do this, must follow whither the food-supply leads. As the members of the community increase, it must break up into separate portions and migrate farther apart in order to find the necessary supplies. In time portions of the community lose touch with the main body altogether. If nothing happens to interrupt the normal course of development this process of growth and fission will go on indefinitely. But when fission has taken place, and all contact between the parts has been lost, the development in many respects will no longer be uniform. New circumstances will arise, new animals and new plants will be encountered, which require to find new names, or at any rate old names must be adapted to new objects. Often there may have been two names for an object, one, let us say, suggested by its colour, another by its shape, or, it may be, one being properly the name for only a part of the object. Here a difference may easily arise. Fashion, or some chance incident, gives the impulse which makes one of the words more current than the other. As there is no literature, in two generations one of the words may be entirely lost. When once one branch has lost the word which has been retained as the name by the other branch, the possibility of easy communication between the branches, should they chance to meet again, is lost. They may have a tradition, or their religious observances may show, that they are of the same stock; but supposing these changes are far reaching, the two bodies of men have become mutually unintelligible and regard one another as foreigners. Nor is the possibility of change confined to vocabulary. The pronunciation of language is continually changing. In Queen Anne's time *tea* was pronounced, as it still is dialectically in Scotland and Ireland, *tæ* or *tay*.

'Here thou great Anna whom three realms obey,
Dost sometimes counsel take and sometimes tea.'

Since the time of the poet Cowper, little more than a hundred years, *balcony* has followed the analogy of the majority of English words, and has transferred its accent from the second syllable to the first. The latest instance of the old accentuation quoted by the New English Dictionary is from 1817; an isolated example of the present pronunciation is found as early as Swift. Even in the present day, when communication between all parts of the world is so easy, the pronunciation of an American is easily distinguishable from that of an Englishman,

even if there be no difference in vocabulary. Another type of English bids fair to develop in Australia. And here it is of importance to note that there is no necessary connection between race and language, although it is a frequent and wide-spread error to assume that different portions of the same race will talk the same language, or at any rate languages closely akin. Yet instances within the period covered by historical records will illustrate the fallacy. The people of Cornwall and of Wales are of the same origin; but while in Wales the language is still spoken which was spoken at the time of the Saxon invasion, in Cornwall it has been replaced by English. Similarly, the Roman conquest of ancient France (Gaul) caused the inhabitants to resign their earlier language in favour of the dialectic form of Latin, the language of their conquerors from Italy. In the east of Europe the Bulgarians, who are of Mongol origin, have adopted a dialect of Slavonic, and, having done so, identify their interests with those of their genuine Slavonic neighbours. (See ETHNOLOGY.)

What then are the causes of the phonetic changes in language? Here our knowledge is still far from complete, but we may at least distinguish causes of two kinds. These are: (1) physiological, (2) historical. All language is learnt by imitation. The infant attempts to form the words that it hears spoken by its parents, its nurse, its brothers and sisters. The effort is difficult, failure is frequent, and only after many months does the child acquire such command of the language as to be intelligible to persons beyond the circle who have watched its development and understand what its badly-reproduced sounds are intended to represent. Even then its vocabulary is very limited, and can only be added to as its needs and its intelligence expand. In the production of sounds machinery of a somewhat complicated kind is employed. The lips, the teeth, the tongue, the gums, the palate (both hard and soft), take part in the operation. Most important of all are the vocal chords, pieces of membrane attached to each side of a cartilaginous box (the larynx) in the throat. (See LARYNX, also VOICE.) The vibration of the edges of these chords when stretched tight, so as to leave only a narrow slit between them, is produced by the expiration of the breath. The vowels are produced by the vibration of the vocal chords, and are distinguished one from another by the position of the tongue and the shape of the mouth cavity. Thus, for the production of *a* (pronounced as *ah*!) the tongue lies low in the mouth, but rises somewhat at the back; for *o* the lips are rounded; for *i* (pronounced as *ee* in *seen*) the upper surface of the tongue is approached to the roof of the mouth behind the teeth, while the jaws are not so wide apart as for *a*. For *u* the lips are protruded as well as rounded; *e* (pronounced as *red*) occupies a position intermediate between *a* and *i*. For consonants like *p*, *t*, *k* (pronounced as *ip*, *it*, *ik*) it will be found that the mouth passage is entirely closed for a brief space by the lips for *p*, by the tongue against (in English behind) the teeth for *t*, against the palate for *k*, while in their production the vocal chords do not vibrate. The sounds *b*, *d*, *g* (in *gig*) differ only from *p*, *t*, *k* in being produced with vibration of the vocal chords. In producing all of these sounds the breath is kept from passing through the nose. If the nose passage is left open we produce, instead of *b*, *d*, *g*, the sounds *m*, *n*, *ng* (in *sing*). These last, as the nose is open, are called *nasal*, and are *continuous* sounds, that is, can be prolonged till the breath is exhausted. The two previous series are called *stops*, because at one moment the breath passage is absolutely closed. The first series are called *voiceless* or *breathed stops*, as distinguished

from the second, which are *voiced stops*. It is possible to produce either series with an audible breath or *h*-sound after them. In English, at the end of words, the stops are really so pronounced. Thus *pip*, *it*, *lick*, &c., end not with *p*, *t*, *k*, but with *p-h*, *t-h*, *k-h*. In some dialects even initial sounds are so pronounced, as in the vulgar Irish *p-hig*. These consonants are said to be *aspirated*. The sound of *r*, when a genuine consonant, as in Scotch or French, is produced by vibrating the tip of the tongue behind the teeth, in German by vibrating the pendulous uvula at the back of the month. The sound of *l* is produced in the same way as *d*, except that the breath is allowed to escape at one or both sides of the tongue.

	Voiced stops.	Voiceless aspirates.	Voiced stops.	Voiced aspirates.	Nasals.	Liquids.
Labials	<i>p</i>	<i>p-h</i>	<i>b</i>	<i>b-h</i>	<i>m</i>	
Dentals	<i>t</i>	<i>t-h</i>	<i>d</i>	<i>d-h</i>	<i>n</i>	<i>l, r</i> (Scotch)
Gutturals	<i>k</i>	<i>k-h</i>	<i>g</i>	<i>g-h</i>	<i>ng</i>	<i>r</i> (German)

The aspirates have to be carefully distinguished from spirants or rubbing sounds, so named because the breath passage is never actually closed, as for the stops, but only narrowed. For these the parts of the mouth affected are, for most sounds, approximately the same as for the stops. There are, however, some sets of spirants, as the two sounds which are both represented in English by *th* (the voiceless in *thin*, the voiced in *thus*) and distinguished by phoneticians by the Old English symbols *þ* and *ð*, to which there is no corresponding series of stops. The same is true of *sh* and *zh*, the first of which is found in *plush*, the second in *pleasure*. (It is to be observed that in English, more than in most languages, spelling is no key to pronunciation, almost every sound in English being represented by a variety of spellings.) There is also a labiodental series of spirants, represented by *f* and *v*, produced by placing the lower lip close to the upper teeth.

	Voiceless spirants.	Voiced spirants.
Labials	<i>wh</i> (as in east of England <i>whine</i> , &c.)	<i>w</i>
Labiodentals	<i>f</i>	<i>v</i>
Dentals	<i>θ</i>	<i>ð</i> (as in <i>blaze</i> , <i>is</i>)
Interdentals	<i>þ</i>	<i>ð</i>
Gutturals	<i>χ</i> (Scotch <i>loch</i>)	<i>γ</i>

Besides these sounds, which may be taken as generic representatives of each kind, different languages sometimes make finer distinctions. Thus some of the languages of India distinguish two classes of dentals—one, genuine dentals, like the French or German; the other, like the English dentals, produced against the sockets (*alveoli*) of the teeth, and therefore called *alveolar*. In the original language from which English and its congeners are descended, two, if not more, series of gutturals must be distinguished, one set called *palatal*, being produced farther forward in the mouth as compared with the other, which, being supposed to be produced against the *velum*, or soft palate, are called *velar*. One of the most difficult tasks of philology is to ascertain for the earlier forms of language what were the exact sounds then existing, the written forms of any language giving but the most imperfect clue to the actual sounds.

The physiological causes for sound change must be connected either with the production or with the hearing of the sound which is produced. A peculiarity in the formation of the mouth, a peculiarity which is often perpetuated through many generations, may cause a difference of pronunciation; for example, abnormally thick lips will modify the pronunciation of the labials, a gap between the front teeth will produce a hissing sound, and so on. In a small isolated community such a peculiarity might

easily permeate the whole body, and as the community increased extend its influence over a wider area. Again, in combinations of sounds it is sometimes difficult to distinguish by the ear what are the two elements. For example, universally in Britain the word *glory* is written in dialect literature as well as in ordinary literary English as if the initial sound was *gl*. Yet northern Englishmen and Scotchmen not infrequently pronounce not *glory* but *dlory*, the mouth getting into position too soon for *l*, and thus attracting the *g* into the position for *d*. So to a German ear an Englishman's pronunciation of the spirant *g* in the German *sagt* (says) often sounds as *sagt*, if it gets beyond *sakt*. The extent to which physiological causes account for sound change has not yet been sufficiently investigated. The historical reasons are on the whole clearer. Most important of all is contact with people who speak a language with sounds which are markedly different. Thus, Germanic *w* in words borrowed by French has become *g*, *gu*, as in *ward*, *guard* (O. French *gardier*), *war*, French *guerre*, &c.; in Russian the mediæval Greek *th*, like the English *th* (*þ*), found in such names as Theodoros, was replaced by *f*, hence Fedor; while in mediæval Welsh this sound, or the earlier *t-h* of classical Greek, was represented by *t* in the same name, which thus appears as Tudor. A similar change has taken place in Latin and its kindred dialects in ancient Italy in such words as *fumus* (smoke) and *facio* (do), which earlier began with a *th* (*þ*) sound, but whether this arose from contact with an alien people we know not. The most remarkable phonetic development which is referred by some scholars to this cause is the great series of sound changes in the Teutonic languages falling under what is known as Grimm's Law (see below). As we have already seen, we cannot trace historically the early migrations of man upon the face of the earth, and therefore it is impossible for us to say how many of the sound changes, which distinguish one language or one set of languages from another, may thus have arisen. It is well known that grown persons, whose cartilages are already fixed, instead of producing the true sounds of any new language, as a rule replace them by the nearest sounds in their own. When two peoples become commingled, whether by conquest or by union in colonization or otherwise, whichever language gains the upper hand will certainly be affected to a greater or less extent by the phonetics of the other. The historical causes of change thus are resolved in the long run into physiological causes.

A further and a very important cause of sound change, which may also be ranked as physiological, is stress accent. Stress indicates that one syllable is pronounced with greater emphasis, that is to say, with greater expenditure of breath energy, than the syllables in its neighbourhood. The result of this is easy to see; stress accent must inevitably tend to shorten words, the syllables which are not emphasized tending to become shorter and shorter till they disappear altogether. Thus, in a combination like *cannot*, unless in the comparatively rare cases where *not* is specially emphasized, the stress is laid upon the first element, *can*. The result is that, in ordinary conversation, the combination is abbreviated to *can't*. It is to be noticed, however, that in this case the abbreviation is not really accompanied by any saving of time, since the time required to pronounce *can't* with its ordinary pronunciation is not appreciably shorter than that required to pronounce *cannot*. No influence in language is so effective in changing the forms of words as stress accent, because in long words, where the accent is on a middle syllable, the preceding as well as the succeeding syllables tend to disappear. The field in which this

phenomenon can be best observed is in the Romance languages, which are all derived from Latin. Here we have what is wanting to the study of most languages, the source whence all these languages have sprung, still in existence, preserved in an abundant literature. It is true they have sprung, not directly from the language of the great writers, but from that of the common people, regarding which we have much less information, but still enough to enable us to recognize without difficulty the changes which have taken place. As we have seen from the example of *cannot*, the rules of stress accent apply not only to individual words, but to such combinations of words as come under one accent. These may be negatives and verbs, prepositional phrases, adjectives and substantives, or whole sentences like the English *good-bye*, out of *God be wi' ye*, where *wi'* is the unaccented form of *with*. Thus, from the late Latin *hospitale* comes the Old French and Middle English *hospital*, whence in English we have *spital* in *Spitalfields*, and *spitel* as a common substantive in Middle English, the initial syllable having disappeared. So the French *blé* (wheat) is a broken-down form of the Latin participle *ab-latvm*, 'carried' (corn), where the initial vowel of the preposition, *ab*, has disappeared. It is more usual, however, for the first syllable to be preserved in long words, for though in Latin words the accent could not be farther from the end of the word than the third syllable if the last syllable but one was short, or than the last syllable but one if that syllable was long, a secondary accent was placed upon the initial syllable. From Late Latin *hospitale*, with this secondary accent on the first syllable, comes the Old French *hostel*, which passed from French into English, and still survives, while *hospitale* has been borrowed a third time through French in modern times in the form *hotel*. Other examples of this double accentuation may be seen in *larceny* and *danger*, the former representing the classical *latrocinium*, the latter a late derivative from *dominus* (lord) through a form *dominiarium*, or rather *domniarium*. Hence in Old French we find *danger*, originally 'overlordship', a meaning which appears in Shakespeare, when Portia, in the Merchant of Venice, says to Antonio, 'You stand within his danger, do you not?' The loss of the *i* between *m.* and *n* is illustrated by the Italian *donna* (out of *domna*, *domina*), 'lady', and in the Middle English *Dan*, an abbreviated and modified form of *dominus*, frequently applied as a title of respect to Chaucer. The effect on combinations of words is seen, for example, in French *cette* (she) from Latin *ecce istam*, in *désormais* from Latin *de-ex-hora-nugis*, while in Portuguese the Latin *ad bonam finem* is abbreviated to *bofé*, 'truly'. It is to be observed that these changes are not made voluntarily. They are the effect of natural causes which act without either the will or the consciousness of the speakers in whose language they arise having anything to do with the matter.

It has often been contended that phonetic change always results from an attempt to economize effort; but as a matter of fact the changes produced by no means always tend to such economy. English and Latin are both descended from the same original language. English has undergone much more change than Italian, which is the direct descendant of the earlier Latin. Yet the effort in producing the sounds of Italian, 'that soft bastard Latin', is much less than for

forms of dissimilation. Thus, when a *k* and a *t* sound come together in such a word as the Lat. *dictum* there is economy of effort in pronouncing it as it appears in the Italian *dit-to*, the tongue remaining for the third sound in the same forward position in the mouth as for the first and fourth, instead of being raised against the palate for the sound of *c* (*k*). When the word is borrowed into English, effort is still further economized by pronouncing it *dit-o*. A further form of economy is seen in the much rarer phenomenon which is called *haplogy*. Here, when two successive syllables have the same sounds or approximately the same sounds, one syllable is dropped. An excellent example of this is the English *idolatry* representing Latin *idolatria*, Greek *eidōlatreia*, 'service of idols'. To this form of dissimilation, which is much commoner in languages like Latin and Greek, the words of which are in general longer than those of English, are closely related the colloquial changes of *library* for *librery*, *secretary* for *secretary*, &c. The metathesis or transposition of sounds in language is no doubt also to some extent the result of the attempt at economy of effort. Different languages and different dialects do not, however, always find the same combinations the easiest to pronounce. Thus, from the earliest records of English there is a variation between the two forms of the verb *ask* and *ax*, the latter of which is the commoner in Old English, however vulgar it may be regarded as being now. Similarly there is in the substantive *wasp* the alternative form *uaps*. Latin consistently adopts the form *vespa* for wasp, while Lithuanian on the other hand prefers *veapsa*. Transpositions of *r* in English occur between dialects and also within the same dialect at different times. Thus, Chaucer has regularly *brid*, *thridde* for the modern English *bird*, *third*, while in Scotch forms *r* is very frequently transposed: *girn* for *grin*, *girs* for *grass* (Old English has both *gars* and *græs*), and conversely *croods* for *curds*, *brod* for *board*, &c. Sometimes the two forms exist side by side as *firth* and *frith*, where the second form, however, may have been created through confusion with the obsolete *frith*, an inclosure, park, or from an erroneous connection with the Latin *fretum*, a strait.

Such are examples of sound changes depending on the mechanical processes of speech. Language, however, is constantly suffering change from another cause—the operation of the mind upon the sounds produced. The results proceeding from this cause are classed together as *analogical* changes. Analogy, however, extends far beyond the phonology or sounds of language; it influences sounds, forms, meaning, syntax alike. Its operation may be summarized under three heads: (i) formal analogy, (ii) logical or material analogy, (iii) a combination of formal and logical analogy. (i) In formal analogy similarity of usage tends to produce similarity of form. Thus in Old English there were a considerable number of ways in which the plurals of substantives could be formed; for instance, in *-an*, in *-ru*, and in *-as*. A great many words which belonged to the first two of these categories have passed over to the third. Thus, *dock* (the plant), O.E. *docec*, made its plural *doccen*; *ēage*, the older form for *eye*, made its plural *ēagan*, whence Middle English *eyen* and Scotch *een*. The plurals in modern English are *docks* and *eyes*. In the Scotch dialect, however, *docken*, corresponding to O.E. *doccen* which formed also the oblique cases of the singular, is used for the nominative singular with a plural *dockens*; while *een* survives instead of *eyes*. Again, *calf*, in Old English *cealf*, had its plural *cealfra*, whence its plural ought now to be *calver*, not *calves*. In the same way the plural of *child* should be *childer*, as it is in many dialects,

'Our harsh northern whistling grunting guttural
Which we're obliged to hiss and spit and sputter all'.

Some sound changes do, however, economize effort. These are the various forms of assimilation and some

corresponding with O.E. *cildru*. Here, however, the plural *childs*, though represented in O.E. *cildas*, has not survived, but the ending *-en* has been added to the plural in *-er*, whence *children*. In Wiclif's time there was a similar plural to *calf*, viz. *calveren*, which also has perished. Again, the plural of *brother* in northern English took the form *brether*, whence, by the addition of *-en*, *brethren*. The plural *brothers*, was not in common use till the time of Shakspeare, who uses *brothers* and *brethren* indiscriminately in the same sense. By a later specialization *brethren* is used of a metaphorical, *brothers* of the actual relationship. The ending *-ed* for the past tense of verbs has encroached on the strong verbs in a manner similar to the extension of the plural *-s* in the substantive, *clomb* and a great number of other strong forms being ousted by *climbed* and others of the same kind. Sometimes a contrast in meaning and a partial resemblance in form lead to confusion between two verbs. Thus, in many dialects *learn* is used in the sense of teach, through a confusion between the Middle English verbs *leren* (teach) and *lernen* (learn), a confusion which characterizes various dialects of German as well.

(ii) The phenomena classified under the heading of logical or material analogy are cases of 'levelling' between forms of the same paradigm which accent or other causes have made to differ. Thus it can be shown that in words like the Latin *dator*, *datōris*, *datōrem*, &c., the long *o* characterized originally the nominative only, and was later extended from it to the other cases. One result of this is that sometimes two words are made out of one. Thus, in English words like *shade*, *shadow*, *mead*, *meadow*, the variant forms arise from the different cases of the older declension, *shadr*, *mead* representing the old nominative, *shadow*, *meadow*, the old dative. In the same way the strong and weak forms of the old preterites like O.E. *sang* (1st and 3rd person sing.), pl. *sungon* (we, you, they sang), each completed a paradigm so that it was possible to say *I sing* as well as *I sang*, and conversely *we sang* as well as *we sung*. Similarly a confusion has resulted between the verbs *fly* and *flee*, because in Old English their past tenses (*fleah*, pl. *flogon*) and past participles (*flogen*) had the same form and because both verbs indicated rapid motion. In Middle English *fledde*, 'fled', the weak preterite of a verb meaning to flow, was adopted as the past tense of *flee* and without remedying the confusion.

(iii) Many new forms arise by what is called 'proportional analogy'; a new form is made with the intention of being parallel to a form of another which had already one form apparently similar. The English *cherry* is made from a borrowed French word *cerise*, a cherry, which was regarded as a plural (*cherries*). Thus, *berries*: *berry* = *cherries*: *cherry*. Similarly American dialect has made *Chinee* as the singular to *Chinese* regarded as a plural.

Analogical forms clearly begin with individuals and spread gradually; they often fail to survive, as some of the examples given above show. A great part of the new words in every language are made analogically on the pattern of words already existing and often wrongly, misconceptions often arising in the popular mind as to the elements of which words are composed. Thus, *foremost*, being a superlative, is popularly regarded as being a compound of *fore* and *most*, whereas the word is really a double superlative, *-m* representing the same superlative suffix as is seen in the Latin *postu-mu-s*, last, while the last part is the same superlative suffix as is found in Greek as *-istos*, in *oligistos*, fewest, &c. From the popular interpretation of the form, however, arises the analogical formation *backmost*. In syntax a development of this kind may be seen going on in

colloquial English at the present moment; *like* bids fair in time to oust *as* as a particle introducing a comparative clause. It has long been possible to say *he loved him like a father*, or, *as a father*, but heretofore (like) *as a father pitieth his children*, so, &c., has been the only common construction for the complete subordinate sentence. Here, however, *like* of recent years has been colloquially much employed for *as*, and by the frequency of its occurrence seems about to establish itself in regular use.

The history of the vocabulary of a language—of its words as distinct from its sounds—is no less complicated than that of the sounds themselves. In any language the part that consists of original creations is comparatively small. A large proportion of the words are formations derived, as we have just seen, by additions and modifications of various kinds from words already existing. A third series of words, which in most languages form an important part of the whole vocabulary, consists of words taken over either from other dialects of the same language or from other languages. No language is so remarkable in this respect as the English, the vocabulary of which includes words borrowed from almost every language under the sun.

With regard to words borrowed from other dialects of the language itself, this may be exemplified by the fact that in English the southern *vat* has replaced the older *fat*, still found in the Bible (twice in Joel), while *fox* has its feminine from the same source in the form *vixen*. From northern dialects the borrowings have been more numerous. Conspicuous among them are the pronouns *they*, *them*, and the verb form *are*. These northern elements, however, are themselves borrowed from the language of the Norsemen who overran northern and eastern England for two centuries before the Norman conquest.

The same influences affect the syntax of a language. Languages of kindred formation probably affect one another most readily. Yet experts profess to discover in the syntax of Welsh characteristics which are supposed to belong to the prehistoric language long extinct which was spoken by the race which preceded the Welsh in the same regions. The syntax of English also has to some extent been modified by French influences.

Philologists have been able to classify the languages of the world into a few great divisions including within them various families of languages which are similar in formation but are not necessarily directly related. (1) The simplest of these divisions is that of the *Isolating Languages*. Of these Chinese is the most typical. Here there is no difference distinguishable between the parts of speech. Each symbol of the extremely complicated system of writing represents a monosyllabic word which expresses a general idea without regard to the nature of that idea, or whether it has the value of a verb or of a substantive. The meaning of the passage has to be gathered (a) from the order of the words, (b) from the intonation. In Chinese and also in the other monosyllabic languages, though to a less extent, there are a number of tones which distinguish words containing the same articulated sounds one from another.

(2) The next class consists of the *Agglutinative Languages*. Here suffixes are added to roots to indicate various relations. The same suffixes appear in the verb and in the substantive in different relations. Thus, in Hungarian, which is one of these languages, we find

ház-unk, our house.
ház-tok, your (plural) house.
ház-uk, their house.

var-unk, we sow.
var-tok, you sow.
var-nak, they sow.

Owing to the possibility of adding together a great number of suffixes in the agglutinative languages there is no difficulty in expressing a statement of considerable length by one word. The boundary line between agglutinative and inflectional languages is not always easy to draw. Thus, Finnish, the most highly-developed of these languages, appears, as far as its substantive is concerned, to be an inflectional language of a very elaborate kind, there being at least fifteen cases. Contrary to the practice of inflectional languages, like Latin or Greek, the same suffix is applied to the same case in both singular and plural.

(3) Next to the agglutinative may be placed the *Incorporating Languages*, of which only one specimen survives in Europe—the Basque, spoken in the valleys of the Pyrenees. The characteristic of these languages is that they express in one form subject, verb, and object; thus, in Basque *dakust*=I-see-it (*d-ikus-t*). Owing to the existence of a prefixed element the forms of languages of this type are specially puzzling. To this class belong the ancient Mexican and the dialects of the North American Indians.

(4) Lastly come the *Inflectional Languages* represented by the two groups of the Semitic and Indo-Germanic languages. It is from the speakers of languages of these two groups that almost everything most beneficial to the development of the human race has sprung. The Semitic languages are (a) Hebrew, closely akin to which were the other ancient dialects of Canaan, Moabite, Phœnician, &c.; (b) Arabic, widely spread as the result of Mohammedan conquests; (c) Aramaic, the language of ancient Syria, which in Palestine also had taken the place of Hebrew as a spoken language before the Christian era; and (d) Assyrian, which has been recovered from countless inscriptions upon clay tablets found on the sites of ancient cities like Nineveh and Babylon. The different Semitic languages do not differ more from one another than do Romance languages like French, Italian, and Spanish. They are, however, generally divided into a northern and a southern group; the southern group being formed of the various dialects of Arabic, the northern group of the other languages, though Aramaic deviates considerably from the rest of the group. The most characteristic feature of the Semitic languages is that with rare exceptions all roots have three consonants or semi-consonants, which, in combination with vowels, form series of words. The verb system is much less perfectly developed than that of the Indo-Germanic system.

To the Indo-Germanic or Indo-European system belong a number of languages and dialects which fall easily into eight groups. These languages are widely spread, extending from India to Iceland in the Old World, and since the end of the fifteenth century having been disseminated over the whole of America, Australia, New Zealand, and the East Indies as the language of European conquerors or colonizers of those lands. The system has been called by other names, as Aryan, which is, however, more appropriately applied to the most easterly group of the languages. The name Indo-European is commonly used, but seems to imply that the languages are spoken only in India and Europe, which is inaccurate, as is also the notion that all Indian and European languages belong to this system. In southern India the Dravidian languages, of which the chief representatives are Tamil and Telugu, are agglutinative languages, and therefore of a different type, while in Europe, Turkish, Hungarian, Finnish, Lapp belong to an agglutinative system, and Basque, as we have seen, is an incorporating language. The names Indo-Germanic and Celt-Indic are each an attempt to express the family by the extreme links

of the chain. The languages belonging to the system are descended from an original language long since lost. Where this language was spoken it is difficult definitely to decide. The best authorities incline to the view that it was in the great plain between the Baltic and the Black Sea. The language was highly developed before the Indo-Germanic community broke up. Before the languages separated one from another this original speech had at least seven cases in the noun declension, besides the vocative, which is the bare stem. In the verb there was a very elaborate distinction of two voices—active and middle, of three moods, indicative, subjunctive, and optative. The imperative was to the verb what the vocative was to the noun, simply the bare stem, while the infinitive is in all the languages only stereotyped case forms from various noun stems. There existed also forms corresponding to those which we call the present, imperfect, future, aorist, and perfect tenses in Greek grammar. But at this early date these forms seem not to have indicated the *time* when the action expressed by the verb took place, but the *manner* in which it took place, the present forms generally expressing a continuous or progressive action (process), the perfect either intensive or repeated action, or the state resulting from an action completed, and the aorist the mere fact of the action having taken place without regard to its duration. The future forms cannot be distinguished morphologically from the present. The only element existing to mark time was the augment—a prefix *e*—which was probably in origin a 'deictic' pronoun, indicating remoteness. In the verb there was also an elaborate system of personal endings which were probably pronominal in their origin, and fall into two series—primary and secondary,—the former appearing in the present and future indicative and in the subjunctive, the latter in the imperfect and aorist indicative and in the optative. The perfect had, at any rate in the singular, a separate series of endings of its own. There were a great many different ways in which the present tense could be formed by suffixes and reduplication.

In this original ('proethnic') language there had also been developed the inflection of the adjective alongside its noun—a superfluity which does not exist (except by contamination with Indo-Germanic languages) amongst the agglutinative languages, and a system of grammatical gender which has been got rid of by English, but which survives in most other languages of the family. This grammatical gender seems to have first begun in the pronoun, and to have passed from it to the noun and adjective. The parts of speech which are distinguished in the grammars all existed in this proethnic tongue, except that the preposition as yet was not distinguished from the adverb, and the relative and the subordinating conjunctions were not greatly developed.

The language possessed at least eleven vowels, *a*, *e*, *i*, *o*, *u* in both long and short forms, and a short neutral vowel *ə*. There were at least twelve diphthongs, *ai*, *ei*, *oi*, *au*, *eu*, *ou*, both long and short, and possibly also diphthongs containing *ə*. Its consonantal system is more difficult to determine, but it seems to have possessed at least sixteen stops, *p*, *b*, *ph*, *bh* (labials); *t*, *d*, *th*, *dh* (dentals); *k*, *g*, *kh*, *gh* (palatals); *q*, *g*, *qh*, *gh* (velars). A large number of the velars were labialized by a slight *w* sound (*u*) which was combined with them in pronunciation; these forms are generally given as a separate series, raising the number of stops to twenty. There also existed a large number of other consonants. There were at least two liquids, *r* and *l*, and four nasals, *m*, and a dental, a palatal, and a velar *n*. Of spirants there existed *s*, *z*, probably also *ʃ* (*sh*), *ʒ* (*zh*), *v*, *y*, and *a*

alighter sound of the same kind written *i*. There were two kinds of accent—pitch and stress. In syllables with weak stress accent the vowel sound was reduced; if a short vowel, it disappeared; if a long vowel or diphthong, it was shortened; if a short syllable contained a nasal or a liquid when the vowel was lost, the nasal or liquid became syllabic, which it could do, as these sounds are continuous. Thus a syllable like *tent*, when not accented, became *tn̥t*, where *n̥* without the help of a vowel has to make the syllable by itself. Similarly *tert* or *telt* would become *tr̥t* and *tl̥t* respectively. These syllabic liquids and nasals are written *r̥*, *l̥*, *m̥*, *n̥* to distinguish them from the consonantal (non-syllabic) values of the same sounds.

1. The most easterly of the eight groups into which this family of languages is divided is the Aryan group. The earliest representatives of this are Sanskrit, Zend, and Old Persian. These languages all agree in confusing together the original *e* and *o* sounds, both long and short, with the original *a* sounds. There are thus but three pure vowels, *a*, *i*, *u* (both long and short), and the diphthongs are correspondingly reduced. In other respects Sanskrit is better preserved than the other languages. While Sanskrit confuses *r* and *l* to a considerable extent, *l* in the other languages has practically disappeared. The earliest literature belonging to the Indo-Germanic family is contained in the hymns of the Rig Veda, some of which go back to 1500 or 2000 years B.C., while some authorities would put them much earlier. Still, when the literature begins the Sanskrit-speaking peoples had not long been settled in India, and had as yet only extended over the upper waters of the Indus and its tributaries. Whole phrases and sentences are found which correspond exactly in Sanskrit and Zend. Even in the earliest Sanskrit there are signs of the breaking down of the mood system in the verb. In the classical Sanskrit, which belongs to a later period—owing to the lack of the historical faculty amongst the Hindus we are unable to fix dates with precision—this break down has taken place, and the tense system has confused together in value imperfect, perfect, and aorist, all of which are used indifferently as preterites. A further stage in the break-down of the form system is seen in Prakrit, and later in Pāli, which stands in the same relation to Sanskrit as Italian does to Latin. Pāli was the language of the great Buddhist revival, which had spread over a large part of India by 270 B.C. The modern dialects of Northern India, Hindi, Bengali, &c., and the language of the Gypsies are still more decadent descendants of Sanskrit.

Zend was the language spoken in ancient times in the eastern part of the Persian empire. It is the language of the religion of Zoroaster, which still survives among the fire-worshippers of Eastern Persia and the Parsis of Bombay. Zend, along with the Old Persian of the cuneiform inscriptions, makes up the Iranian subdivision of the Aryan branch. Within Zend itself there is noticeable a difference of dialect between the hymns (*gāthā*) and the rest of the Zoroastrian literature, the hymns being more archaic than the rest, and standing in the same relation to the later Avesta that the Veda does to classical Sanskrit. Some at least of the hymns contain the teaching of Zoroaster himself (about 1100–1000 B.C.), and the whole prayer-book, of which the literature preserved is but a small portion, was compiled before the fifth century B.C. In the turmoil which followed Alexander's conquest the tradition became corrupted, the language died out, and it was not till the time of the Sassanid dynasty, and probably in the fourth century A.D., that the fragments, as we have them, were again collected, though three-quarters of what

was then known have since perished. The Old Persian of the cuneiform inscriptions (see CUNEIFORM WRITING) begins with the inscriptions of Darius Hystaspes (about 520 B.C.). These, and above all the great Behistun inscription engraved on the face of a precipitous cliff 300 feet from the ground, are the most important, but others of various dates exist down to about 350 B.C.

As compared with Sanskrit, the Iranian languages show some sound changes. In Zend these changes are greater than in Old Persian, which retains the vowels unchanged, except that nasalized vowels lose the nasal sound. Both Zend and Old Persian have lost the aspirates, most of which have passed into spirants. The morphology of the languages is much like Sanskrit. Old Persian, however, has lost the dative case, which it has replaced by the genitive. From Old Persian was descended the Pehlvi dialect, which was the language of Sassanid times. Modern Persian has been largely influenced by Arabic—a result of the Mohammedan conquest, and has lost its inflexion. Other modern dialects of Iranian origin are those of Afghanistan and Beluchistan, the Pamir dialects, Ossetic in the Caucasus, and the dialect of the Kurds.

2. Proceeding westwards the next member of the stock which we find is the Armenian. This language, which possesses a literature going back to the fifth century A.D., is so full of Iranian words that till 1875 it was looked upon as a branch of Iranian. It differs, however, from Iranian in preserving the original *e* sound. Its most remarkable peculiarity is the phonetic changes in its stop sounds, which to some extent resembles the Germanic sound change known as Grimm's Law (see below), but is more perplexing because the spelling remains unchanged, *d*, *b*, &c., being written, though pronounced *t*, *p*, &c. It is now established that the ancient Phrygian, from which Armenian is descended, was the language of a Thracian tribe which emigrated in early times from Europe to Asia Minor.

3. More important in the history of the world is the next group—Greek. The earliest Greek preserved to us—unless the clay tablets recently discovered in Crete should be proved to be Greek—is the Homeric poems. The language of these poems, however, is clearly a literary language—Epic—and not the spoken dialect of a particular place. Owing to the geographical formation of Greece the language was broken up into a multitude of dialects, which are generally grouped under three heads:—(a) *Æolic* is the dialect of Lesbos and the mainland opposite, of Thessaly, and partly of Boeotia, which is influenced by Doric. (b) *Attic-Ionic* is the language of Attica and Ionia, and of the greater part of Greek literature. Attic is represented in a literary form differing in some respects from the spoken language by the great tragedians *Æschylus*, *Sophocles*, and *Euripides*, and the historian *Thucydides*, while the spoken language is preserved in *Aristophanes*, *Plato*, *Demosthenes*, and the other orators. After *Demosthenes* the language changes considerably, and passes into Hellenistic Greek or the common dialect (*koinē*), which is represented in the Alexandrian writers. The chief representatives of the Ionic dialect are *Herodotus* the historian, and *Hippocrates* the physician. (c) *Doric* dialects were spoken in the Peloponnese, in *Argolis*, *Laconia*, *Messenia*, *Corinth*, in *Crete*, *Melos*, *Thera*, *Cos*, *Rhodes*, and the adjacent parts of *Asia Minor*, and in some of the great colonial towns like *Syracuse* and *Aggrigentum* in *Sicily*, *Tarentum* in *Italy*, &c. In literature its chief representatives are *Theocritus*, the bucolic poet, and *Archimedes*, the mathematician, though the dialect of neither is pure Doric. Other dialects of much

interest, but known only from inscriptions, are found in Arcadia with its prehistoric colony Cyprus, Ellis, and North-west Greece. No Greek record as yet discovered can be dated with certainty as older than the seventh century B.C. Modern Greek means two different things: (a) the local dialects descended, with much mutilation, from earlier Greek—the ancient Laconian dialect alone is clearly continued in its modern representative—and (b) an artificial dialect, modelled on ancient Greek, and used in newspapers and literary works.

The chief characteristics of ancient Greek are, that, having little stress accent, it maintains the original vowel system better than any other Indo-Germanic language, that its mood system is better preserved than that of Sanskrit, its only rival in this respect; while on the other hand it has confused together the locative, instrumental, and dative cases, and has considerably modified its consonant system, converting the voiced aspirates *dh*, *bh*, &c., into breathed aspirates, *th*, *ph*, &c., losing between vowels the original spirants, *w*, *z*, and *s*, and changing original *y* into *z*.

4. Next in order comes Albanian, the modern representative of the ancient Illyrian. This has only recently been recognized as a separate member of the system, its vocabulary being even more packed than is Armenian with foreign words. Latin, Slavonic, Greek, and Turkish have all contributed some elements. Its literature does not extend further back than the seventeenth century. It is characterized by numerous vowel changes, and by the change of initial *s* in certain circumstances to a palatalized *g* sound. Besides in Turkish Albania the language is spoken in settlements in Greece and South Italy.

5. The dialects of Italy. These fall on the one hand into Latin and the little-known dialects of Falerii and Præneste, on the other hand into Oscan, the language of the ancient Samnites and of Campania, the dialects of various smaller tribes including the Sabines, Pelgimians, &c., and the dialect of Umbria in north-eastern Italy. Latin, originally the dialect of a very limited area, gradually spread over the whole of Italy as the result of the military conquests of Rome. The conquest of other countries is marked by the appearance of the Romance languages, which have their origin in Latin spoken by people who were not Romans. Hence, besides Italian, we have French, Spanish, Portuguese, Provençal (the language of the south of France and of Catalonia), the dialect of the Rhetian Alps, and Roumanian. The earliest inscriptions (one on a brooch found at Præneste in 1886, another on a broken pyramidal pillar discovered during excavations in the Roman Forum in 1899) do not go further back than the sixth century B.C., and records are not abundant till the time of Plautus, 200 B.C. The classical period of the literature is comprised within the century preceding and the century following the birth of Christ. The later literature, however, is of great interest to the student of language.

The chief characteristics of this family are these: Indo-Germanic *dh* passed into *p* (English *th*—in *thin*), and thence into *f* initially; Indo-Germanic *s* between vowels passed into *z* and then in Latin and Umbrian into *r*; owing to a strong stress accent the unaccented vowels are reduced to neutral vowels; it preserves its noun system well, Oscan preserving the locative which is lost in Latin by confusion with the ablative in the consonant stems, and by being used for the genitive in *o* stems (the second declension). On the other hand, the verb system has been entirely recast owing to (a) the formation of new middle (deponent) and passive forms with a suffix in *-r*, which it shares with the Celtic languages; (b) the formation of new imperfects in all conjugations (in Latin *-bam*), and

in the first and second conjugations by the formation of new futures (in Latin *-bo*); (c) the confusion of the perfect and aorist; (d) the confusion of the original subjunctive and optative; and (e) losses and additions in the participial system.

Latin and Faliscan are distinguished from the other dialects by having *q*^u and *v* for labialized velar voiceless and voiced stops, while the other dialects have *p* and *b*: thus, Latin *quis*, Oscan *pis*, &c.

6. Celtic. Here the ancient language of Gaul, of which some fragments remain, Welsh, Cornish, and Breton—the language of settlers from Cornwall in the ancient Armorica—form one group (with *p* for *q*^u), while Irish, Scotch Gaelic, and Manx form the other (with *c* for *q*^u). The oldest Runic or Ogham inscriptions go back probably to 500 A.D. or 600 A.D. In Irish and Welsh there is a large literature beginning with the eleventh or twelfth century. The important features which Celtic shares with the dialects of Italy have been already mentioned. Besides may be mentioned the total loss of Indo-Germanic *p* as in Old Irish, *ore*, *pu**g*, Lat. *porcus*; or *athir*, father, Lat. *pater*, and the new formation of preterites in *-ss*.

7. The Germanic or Teutonic dialects. The oldest literature in these is the fragmentary Gothic translation of the Bible made by Bishop Wulfila (Ulfilas) in the fourth century. The Norse, the earliest remains of which are the Runic inscriptions from Jutland and Schleswig, which date probably as early as the third or fourth century A.D., splits after the age of the Vikings into four dialects, Icelandic, Norwegian, Swedish, Danish. Icelandic possesses the best early literature in any Germanic language. A third group of these dialects is the West Germanic, comprising Old English (Anglo-Saxon), Frisian, Low German, Low Franconian (whence Dutch and Flemish), and High German. The English settlers in Britain came from Friesland and the neighbouring coasts as far as Jutland, and in the fifth century A.D. ousted the Britons from the eastern side of England and drove them into the mountainous peninsulas of the west.

The most remarkable feature of the Germanic dialects is the sound shifting known as Grimm's Law. The causes of the changes are somewhat obscure; they are generally asserted to have arisen from a mixture of a Teutonic and a Celtic people in the extreme south of Germany. The result of the change has been that original *p*, *t*, *k*, *q*^u appear in English, except in cases otherwise explicable, as *f*, *th*, *h*, *hw* (now *wh*); original *b*, *d*, *g*, *g*^u as *p*, *t*, *k*, *qu*; original *bh*, *dh*, *gh*, *g*^u *h* as *b*, *d*, *g*, *w*. This will be obvious from a comparison of the initial sounds of the following Latin and English words of the same derivation (the original Indo-Germanic sound in the last five cases being different from the sounds of both languages): *pater*, father; *tu*, thou; *cor*, heart; *quod*, what; *baculum*, peg; *dens*, tooth; *genus*, kin; *vivus* (initial *v* for *g*^u), quick (alive); (original *bh*) *frater*, brother; (*dh*) *fores*, door; (*gh*) *hiemps* (winter), *gimmar* (a lamb one winter old); (*g*^u *h*) *formus*, warm. To this law, propounded by Jakob Grimm in 1822 (though it was known, at least in part, earlier), there were certain exceptions which remained a puzzle till in 1875 Karl Verner showed that when the original accent fell on the syllable following medial *p*, *t*, *k*, *q*^u, these sounds, instead of changing as above, became *b*, *d*, *g*, *w*, while *s* became *r*. The discovery of Grimm's Law laid the foundation of a large part of the modern development of comparative philology.

The differences between English and German are largely occasioned by a second sound shifting, characterizing High German only, which spread from

the extreme south down the Rhine and worked itself out about Düsseldorf. The changes were neither contemporaneous nor coextensive, but their general effect was to change initial Germanic *p*, *t*, to *pf* and *z* (*ts*), medial and final *p* and *k* into *f* and *ch* (as in Scotch *loch*), *d* into *t*, and *th* into *d*.

8. The Slavonic group falls into two sections: (a) the Baltic or Lettic, including Lithuanian and Lettish, which are still living languages, and Old Prussian; (b) Slavonic proper, which includes a great variety of dialects (see SLAVES), the oldest literature existing in the Old Bulgarian or Old Church Slavonic. The chief characteristics of this group are that the noun system, except for the replacing of the genitive of *-o* stems by the ablative is preserved intact; in the Slavonic verbs the aorist is retained, and the different kinds of action (process, fact, state) are very clearly distinguished. A special declension of the adjective (the definite or emphatic declension) is formed by suffixing the pronominal stem *yo-* to the full word and declining both.

It is noteworthy that one characteristic at least seems to mark a dialect difference before the original community broke up, viz. the treatment of the palatal sounds *k̂*, *ĝ*, *gĥ*. In the Aryan, Armenian, Albanian, and Slavonic groups these sounds pass into sibilant forms, *s* or *ç*, *z*, &c.; while in the other languages they remain stop sounds. Again, the labiovelars appear without any trace of labialization in the same group of languages.

Literature.—Comparative philology became possible only after Sanskrit began to be studied at the end of the eighteenth century. The first treatment of the subject for the Indo-Germanic languages was by Franz Bopp in his Comparative Grammar of Sanskrit, Zend, Greek, Latin, Lithuanian, Old Slavonic, Gothic, and German, first published (in German) in 1833 and following years. This was followed by Schleicher's Compendium of the Comparative Grammar of the Indo-Germanic Languages: first edition (in German) 1861, fourth and posthumous edition, 1876. The standard work for the present day is Brugmann's Grundriss der vergleichenden Grammatik der indogermanschen Sprachen, 1886-1892, translated into English in five volumes by Wright, Conway, and Rouse. A new edition of the Phonology appeared in German in 1897. As a continuation of Brugmann's work Delbrück has published a Comparative Syntax in three volumes (1893-1900), which has not been translated into English. For the Comparative Grammar of the Semitic Languages see Renan Histoire des Langues Sémitiques, of which only one volume ever appeared, and Wright, Lectures on the Comparative Grammar of the Semitic Languages, second edition 1899. For the general principles, see Whitney, Language and the Study of Language (1st ed. 1867); Sweet, History of Language (1900); Strong, Logeman, and Wheeler, Introduction to the Study of the History of Language, 1891 (an adaptation for English readers of Paul's Principien der Sprachgeschichte, now in its third edition, 1898). For the History of Comparative Philology and the controversy as to phonetic laws and analogy, see Giles, Short Manual of Comparative Philology, for Classical Students, part i. (second edition, 1901); Delbrück Einleitung in das Sprachstudium (third edition, 1893). For the History of Meaning, see Bréal and Postgate, Semantics, (1900). For the Philology of Language, Oertel: Lectures on the Study of Language (1901); Wundt: Völkerpsychologie: die Sprache, 1900; Mustel: Charakteristik der hauptsächlichsten Typen des Sprachbaues, 1893. (See also our article ETYMOLOGY.)

PHILOMELA, in Greek mythology, a daughter of Pandion, king of Athens, transformed into a

nightingale. Progne, sister of Philomela, married the Thracian prince Tereus, by whom she had a son, Itys. When Itys had grown up Tereus went to Athens, and at the persuasion of his wife took her sister with him on his return. On the way Tereus violated her person, and to conceal his crime cut out her tongue. But Philomela made it known to Progne by means of some tapestry, on which she embroidered her story. To gratify their revenge they murdered Itys, and served him up at table to his father. After this horrid deed they were all transformed into birds—Philomela into a nightingale, Progne into a swallow, and Tereus into a hoopoe.

PHILOPEMEN, the last great military commander of the Greeks, was born at Megalopolis about B.C. 252, and gained so much military distinction that in 208 B.C. he was appointed *strategus* or commander-in-chief of the forces of the Achaean League. (See GREECE and ACHÆANS.) After having reorganized the Achaean army he led it against Machanidas, tyrant of Sparta, whom he signally defeated, himself slaying Machanidas with his own hand. In 201 he was again elected *strategus*, and defeated Nabis, the successor of Machanidas. After he had a second time defeated Nabis, the latter was murdered, and Philopemen induced the Spartans to join the Achaean League, but they soon separated from the confederacy, and called in the Romans to their assistance. Philopemen, as commander of the Achæans, declared war against Sparta, and, having taken the city, treated it with the greatest severity. The Romans now interfered, and finally prevailed on the federal congress to admit Sparta again into the confederacy as an independent state. Hardly was this affair settled when Messene revolted. Philopemen, though broken by infirmity and disease, marched against the insurgents, and at first beat them back, but was afterwards obliged to give way, and, falling into the hands of the enemy, was carried in chains to Messene. Here he was cast into a dungeon, and compelled to drink poison, B.C. 183.

PHILOSOPHER'S STONE. See ALCHEMY.

PHILOSOPHY (Greek, *philosophia*, literally, love of wisdom) is a term which was first brought into general use by Socrates, who employed it to denote the science that deals with the causes and existence of things. The origin of the term itself is attributed, though on doubtful authority, to Pythagoras, who modestly styled himself *philosophos*, lover of wisdom. Philosophy is a science; but, unlike other sciences, it is not conversant about any special range of phenomena with their approximate causes, but deals rather with the general principles which form the basis of these sciences, and of which they themselves take no cognizance. It follows up the *data* of experience to their ultimate grounds, regarding each particular fact in relation only to a final principle, and as a determinate link in the system of knowledge. In this view philosophy may be defined as the science of principles. The progress of the science will be best seen in its history, which presents us with a series of philosophical systems exhibiting thought in its various stages of development. Accordingly in what follows we shall endeavour to trace a brief outline of the history of philosophy.

In dealing with the history of philosophy authorities very commonly divide it into the ancient, mediæval, and modern periods. Some divide it into the Greek (including the Greek philosophy in the Roman Empire) and the modern European. In this division the philosophy of the middle ages forms, as is obvious, the transition. The first period begins with the Greek, because, though the disposition to philosophize is confined to no particular nation, philosophy was first studied scientifically by the Greeks.

The philosophic notions of the inhabitants of the East must be mentioned in such a history principally as introductory, and with reference to their connection with the Greek philosophy, in which many oriental notions were incorporated.

The general characteristics of oriental speculation are the absence of method, the predominance of imagination, and the confusion of the domains of the different sciences. In particular we find no separation between thought and feeling, religion and philosophy. The infinite, the eternal, and the absolute are represented by myths and allegories, and vast metaphysical superstructures are erected upon purely hypothetical bases. As to doctrine pantheism in one or other of its forms everywhere prevails. Nature is the great object of study and of worship, and to lose all personality and become absorbed in the universal life that circulates throughout nature is the one thing to be aimed at. Amongst the Hindus pantheism (which see), which is at once their religion and their philosophy, presents itself under two forms—a positive and a negative; the former represented by Buddhism, and the latter by Brahmanism. In Brahmanism the transcendent god Brahma manifests himself in the threefold character of an organizing force—Brahmā, the universal soul; a preserving force—Vishnu; and the power by which all individual beings are reabsorbed and lose themselves in Brahma—Śiva. Connected with this are the doctrine of the transmigration of souls, the principle that whatever is is right, leading to the destruction of all moral distinctions, and the system of caste. Buddhism, on the other hand, goes a step further, and transforms Brahmā into Nirvāna, that is, nothing. The highest goal of the Buddhist is to withdraw himself from the world, and to lose himself in Nirvāna. Annihilation is his heaven, as his god is negation. Pantheism gave rise to mythology, in awakening the desire to select for worship particular manifestations of the divine, hence the immense number of the Hindu deities. In Persia we find a decided advance upon India. There is here the recognition of a distinction between good and evil. They regard light as the principle of all things—the one Universal Being. Light is not only opposed to darkness, but is the symbol of purity and truth. The end of man's life, according to Zoroaster, was to keep himself pure, and spread this purity around him. The antagonism between Ormuzd and Ahriman, representing respectively the principles of good and evil, will end in the complete triumph of the former; the wicked will be finally reclaimed from the dominion of evil, and an era of universal righteousness supervene. Egypt forms the point of transition from eastern to western philosophy. The Egyptians worshipped the mystery of animal life. The mystery and perpetuity of life are represented by the Sphinx and Phoenix, and are seen in the god Isis, who is represented as saying, 'I am that which was, and is, and is to come.' The Greeks are indebted for much to the Egyptians, as much of what is theirs is but a development of what they found in a crude state in Egypt.

In Greece first, says Hegel, was the light concentrated into the lightning of thought. The first problem of Greek philosophy was to explain the enigma of external nature, to account for the spectacle of the material universe, to solve the problem not of the soul but of the world. Philosophy proper begins with Thales, who advanced the notion that water was the principle of all things. Thales of Miletus (about 600 B.C.), stands at the head of the Ionian school, which, with the Eleatic school, were the chief representatives of speculative thought in pre-Socratic times; the former of these schools being characterized by Aristotle as seeking to find a material, the latter a formal

principle of all things. Following Thales, Anaximander assumed an ethereal principle filling space, which by successive combinations constituted the universe. The next philosopher of this school, Anaximenes, made air the principle of all things. The Pythagoreans (see PYTHAGORAS) advanced from a sensuous to a symbolical principle. This principle was number. Number with them was the essence of all things. A further advance was made by the Eleatics, who, transcending the sensuous principle of the Ionics, and the quantitative principle of the Pythagoreans, conceived of pure being as the one sole substance, the phenomenal world being viewed as unreal. The three great philosophers of this school are Xenophanes, to whom it owes its foundation, Parmenides, and Zeno, who are separately treated of in this work. The transition from abstract to concrete, being from the Eleatic principle of unity to the world of phenomena, was attempted by Heraclitus (about 520 B.C.), who asserted for absolute principle the unity of being and non-being—becoming. According to him it belonged to the very nature of things that they should be in constant flux. This flux is the product of conflicting opposites, of the One at once warring and harmonizing with itself. The question then arose why all things were in constant flux. Heraclitus left this question unanswered. Empedocles (440 B.C.), in attempting to solve it, advanced the theory that matter was the principle of permanent being, while force was the principle of movement. The two moving forces in his system were love and hate. According to the Atomists, on the other hand, who are represented by Leucippus and Democritus (450 B.C.), the moving forces became an unintelligible necessity, by which the atoms or material constituents of the world are made to combine and form the world and all that is in it. When Anaxagoras (born about 500) announced his principle of reason, saying that all things were in chaos till reason came to arrange them, he was, according to Aristotle, like the first sober man raising his voice amid the confusion of persons speaking at random. It was a great step in advance of his predecessors, this introduction of an intelligent principle. He did not, however, develop the principle to any extent; but the importance of the mere expression of a spiritual principle is sufficient to mark it as forming an era in philosophy. In the hands of the Sophists this principle in the sense of individual reason became the occasion of their denial of all objective reality. Their teaching was a polemic against former schools of philosophy. Everything must justify itself to the individual reason. 'Man is the measure of the universe.' And this principle of subjectivity they developed to the destruction of the authority of custom, law, and religion, the validity of reason, and any solid foundation of truth. In Socrates (470–399 B.C.) the destructive teaching of the Sophists finds its keenest opponent, and with him philosophy enters upon a new era. What distinguishes Socrates most is his scientific method coupled to his religious spirit. Aristotle says he first used induction in general definition, and even his profession of ignorance and his irony were parts of his method. He attempted to establish the notions of moral and religious obligation, and to give unity to morals by means of the conception of the ultimate end of action. What are called the minor Socratic schools—the Cynics, Cyrenaics, and Megarians—severally professed to regard Socrates as their founder. Though differing widely from each other in regard to doctrine they agreed in regarding the end of action as individual; but the Cynics defined it as self-sufficiency, the Cyrenaics as pleasure, and the Megarians as reason. With Plato (430–347), who now falls to be noticed, philosophy

lost its one-sided character. Though professedly a disciple of Socrates his system is his own. This system is idealism. The Platonic idea is the pure archetypal essence, which is the source of all the finite realities that correspond to it. It is the perfect in its kind, and the given reality remains perpetually inferior to it. All finite and individual objects serve only to recal the invisible absolute. All the ideas lead up to one single one, the idea of the good, which is God himself. Each species is a divine idea, and the visible world is just a reproduction of the world of pure ideas, where shine in all their splendour the good, the true, and the beautiful. In logic Plato brings back science to general ideas. The soul, which he defines as reason served by a body, has three faculties—rational intuition; the heart; and the lower appetite, the source of physical sensibility. In ethics the highest end of man is regarded as the unity of his nature. He recognizes four virtues—wisdom, or the virtue of the intellect; courage, or the virtue of the heart; temperance, or the virtue of the lower appetites, and lastly, justice or social virtue. Man should aspire to resemblance to God, the architect of the world, and should reflect the divine ideas in his own works. Plato's ideal theory is criticized by Aristotle, because he gives no real explanation of the connection between the phenomenal and the ideal. In Aristotle's own system, instead of beginning with the general and the absolute, as Plato had done, he begins with the particular and individual. He seeks the idea only in its concrete realization. His whole philosophy is a description of the given and empirical; and his method is induction, that is, the derivation of general inferences and results from a sum of given facts and phenomena. His system presents us with a number of co-ordinate sciences, each having its independent foundation, but no highest science which should comprehend them all. To Aristotle all finite existence is made up of two elements—form and matter, and the finite world is an ascending scale of realizations of form in matter. His idea of the divine nature is that it is form without matter, being in perfect activity. God is represented as the cause, but apparently only as the final cause of the world. Aristotle was the founder of several sciences unknown before him. Not only logic, but likewise natural history, empirical psychology, and the theory of morals have him as their founder. The three schools of Greek philosophy which followed the systems of Plato and Aristotle, and which mark the declining days of Greece, are those of the Stoics, Epicureans, and Sceptics. All individualistic and subjective in their character they indicate the emancipation of the individual from society and the state, and in so far as they bring into prominence the importance of the individual, of man as man, they make an advance in philosophy. In the systems of Plato and Aristotle the individual was only of importance as a member of the state; merely as a man he was nobody. At one in regard to this new principle of individuality, the three schools above mentioned differed very materially from each other in other respects. The Scepticism of Pyrrho denied the possibility of certitude concerning anything objective, and proposed a thoughtless and aimless acquiescence in the impulses of nature as the law of life. Epicurus made happiness the end of life; but happiness is not with him, as it became with his followers, momentary physical pleasure, so much as moral pleasure equivalent to virtue. The happiness, however, of the Epicureans soon degenerated into mere sensual indulgence. Stoicism presents us with a very different picture. This school, founded by Zeno and developed by Cleanthes and Chrysippus, sought to establish a discipline of virtue in a degenerate age. Life,

according to the law of nature, was the principle that animated their philosophy; in man this principle was reason. To follow nature was to follow reason. Intellectual or rational existence is thus alone recognized; passions, pleasures, and pains are to be ignored and despised.

Rome had no philosophy properly its own; the universal character of Roman philosophizing was eclecticism, of which Cicero was undoubtedly the most illustrious representative. In Alexandria eastern and western philosophy, as also Judaism, Christianity, and Paganism, came into contact. Neo-Platonism strove to combine, in opposition to Christianity, the chief elements of classical and eastern speculation. Hellenic ideas were mingled with a vague symbolism, and with theories of ecstasy and divine union. The founder of Neo-Platonism was Ammonius Saccas (A.D. 193), and the system was further developed by Plotinus, Porphyry, and others, till the death of Proclus in 485, who was the last of the series of Neo-Platonic philosophers. Christianity, in the apologists of the second century and the Alexandrine fathers, related itself very early to the philosophy of the time; and afterwards in the ninth century Scotus Erigena took the lead in attempts to combine it with Neo-Platonism. Not, however, till about the eleventh century did there begin to manifest itself on the part of the Christians a distinctive philosophy in Scholasticism. The general character of Scholasticism is the conciliation between dogma and thought, between faith and reason. Assuming the dogmas of the church to be absolutely true they sought to justify them to the reason, and so rationalize them.

Modern philosophy, which begins with the fifteenth century, is characterized by a freer, more independent spirit of inquiry, penetrating deeper and deeper into ultimate causes, and striving for a systematic union of knowledge. First the scholastic philosophy was attacked by those who called to mind the ancient Greek philosophy in its original purity. After this struggle new views were presented. Some built upon experience, as Bacon and Locke. In opposition to them Descartes strove to establish philosophy on its own ground by dialectic reasoning. Bacon and Locke on the one hand, and Descartes on the other, stand respectively at the head of the two systems—empiricism and idealism, which begin modern philosophy. In his *Novum Organum* Bacon takes a path directly opposite to that universally followed in his time, and instead of appealing by dialectics to the notions of the understanding he attempts to restore knowledge by the aid of observation, through induction. He substituted nature and observation for ideas and logic; made utility instead of theory the object of research; opposed efficient to final causes, and individual things to generic notions. He created no definite system of philosophy, though he gave a new direction to thought, and the empiricism which he founded was heightened in its sensualistic and nominalistic tendencies as it logically advanced, and finally developed into scepticism. Descartes, at the outset of his system, sought to get rid of all presuppositions and assumptions. He doubted everything, but did so only in order that he might attain to more certain knowledge. The first truth he established was his own existence, *Cogito, ergo sum*, and everything as clear as this proposition he assumed as absolutely true. These are the innate ideas of Descartes. The basis of his system is the dualism and antagonism of spirit and matter, subject and object, an opposition which is only overcome in God, who is the absolute substance. The system of Descartes was opposed by Gassendi, and received modifications at the hands of Geulinx and Malebranche. The most important

successor, however, of Descartes was Spinoza. The scheme of Spinoza reduces the three Cartesian substances to unity, to one infinite original substance, the ground of all things, that excludes from itself all negation or determination, and is named God or nature. To this belong an infinite number of attributes, of which two only are known to us, thought and extension. Modes are the changing forms of these attributes. To regard finite things as distinct individualities is the mistake of our imagination; the reason contemplates them only as *natura naturata*, in which the *natura naturans* is revealed. Spinoza's is the most elaborate of all systems of pantheism. Locke (1632-1704), who had a precursor in Hobbes (1588-1679), the influence of whom, however, chiefly concerned the history of political science, is regarded as the father of modern materialism and empiricism. Two leading thoughts run through his philosophy: first, that there are no innate ideas, as Descartes had maintained; and second, that all our knowledge springs from experience. The mind is a mere mirror of the external world, a dark room into which the images of external objects enter, without any contribution being furnished on its part; its entire contents are due to impressions made on it by material things. Locke, however, did not always remain true to his principles, and it remained for his successors to carry them to their ultimate conclusions. As occupying the general position of Locke mention may be made of the names of the illustrious Isaac Newton (1642-1727); Samuel Clarke, a disciple of Newton's, principally interested in moral philosophy (1675-1729); and the English moralists of the period, William Wollaston, the Earl of Shaftesbury, and Francis Hutcheson. The philosophy of Locke received a further development in France. There Condillac sought to explain the development of humanity by the simple development of the sensations. Others went further and reduced sensation itself to a purely physical phenomenon. Then followed the materialism of Helvetius, d'Holbach, La Mettrie, and others, including several of the Encyclopedists, though neither Voltaire, Diderot, nor d'Alembert belonged properly to the school of materialists. The result of this philosophizing was to make the material world the only form of existence, mind only a collection of atoms, the basis of its action egotism, and the end of these actions a refined sensuality. The belief in moral freedom, virtue, God, providence, and immortality were thence regarded as folly unworthy of a reflecting mind. In opposition to the materialism we have been considering there arose the system of idealism. Just as the former seeks to materialize mind, so the latter seeks to spiritualize matter. The one holds that there are only material things, and the other, as represented by Leibnitz and Berkeley, that there are only spirits and the thoughts of spirits—ideas. Every substance, according to Leibnitz (1646-1716), possesses an activity of which we can only gain an idea by comparing it to the activity of our mind, and which he denominates perception, as causing us to know, and appetition, as causing us to will. The universe is an aggregate of intelligent, self-active, immaterial points, which he calls monads, and which combine as elements to form everything. Each monad has a nature peculiar to itself, and cannot be acted upon by anything external to itself. The soul, which is a conscious monad, cannot therefore act upon the body, and the relation between them is due to a pre-established harmony, God having so constituted them in the beginning that they operate in perfect harmony, though independently. God is the sufficient cause of the universe, and the world is the best of all possible worlds. The theories of Leibnitz were systematized by Wolff, and from his time to Kant German

philosophy assumed no new stand-point. Berkeley (1684-1753), founding on Locke's principle that we are percipient of nothing but our own perceptions and ideas, and that all the objects of human knowledge are ideas of sensation or reflection existing in the mind itself, comes to the conclusion that the existence of bodies out of a mind perceiving them is impossible, and a contradiction in terms. Granting the premises of Berkeley, which were the commonly received philosophical views, at least in England, his conclusions could not be refuted; but it was reserved for Hume to trace out, by a vigorous and unshrinking logic, the legitimate consequences of the Cartesian and Lockian philosophy to their ultimate results, and thus, though unintentionally, by a sort of *reductio ad absurdum*, to produce the great metaphysical revolution of which Reid and Kant were the first movers.

From the data of Locke Hume deduced the negation of all causality, all notions expressive of a relation of necessity being merely the result of an association of ideas. The ego or self is nothing more than a bundle of ideas: it is quite illusory to suppose a substratum called the soul underneath these ideas. The scepticism that follows from premises like these may be easily inferred. Properly speaking, it ends in *Nihilism*, God, mind, and matter being alike denied. The attempt to oppose the scepticism of Hume gave birth to the Scottish or 'common sense' school of philosophy. This school, modest and perhaps timid in its pretensions, has the merit of having first strongly and largely inculcated the absolute necessity of admitting certain principles as the foundation of all reasoning, and the indispensable conditions of thought itself. According to the Scotch philosophers certain simple ideas are implied and involved in certain intuitive judgments of the mind; thus identity, cause, time, number, truth, certainty, probability, are ideas peculiar to a rational mind, and necessarily arise in the human understanding when employed in the exercise of its different faculties. Reid, therefore, while he rejected the Cartesian theory of ideas or images in the mind being the only objects of thought, directed his inquiries to an analysis of the various powers and principles of our constitution, in order to discover the fundamental laws of belief which form the groundwork of human knowledge. Though professing to build only on experience he did not limit experience to the relations of sense and its objects. Without claiming for man more than a relative knowledge of existence, and restricting the science of mind to an observation of the fact of consciousness, he analyzed that fact into a greater number of more important elements than had been recognized in the sensualist school. He showed that phenomena are revealed in thought which cannot be resolved into any modification of sense; that intelligence supposes principles which, as the conditions of its activity, cannot be the result of its operations; and that the mind contains notions which, as primitive, necessary, and universal, are not to be explained as generalizations from the contingent and particular, about which alone our external experience is conversant. Dugald Stewart, with some deviations, followed in the track of his master; but Thomas Brown, while he adopted not a few of the principles of Reid, departed on many points of fundamental importance from his philosophy. The same occasion that give rise to the Scottish school—namely, the sceptical conclusions of Hume and others—also produced the philosophy of Immanuel Kant. Kant (1724-1804), who may be justly regarded as the father of the philosophy of the nineteenth century, sought to bring together into unity the one-sided endeavours of his predecessors in the realistic and idealistic schools. He took up a critical

stand-point, and from it instituted an inquiry into the origin of our experience or cognition. All cognition is the product of two factors—the knowing subject and the objects known. The one factor, the external object, contributes the material of knowledge; the other factor, the subject, contributes the form, or those notions in virtue of which alone any connected knowledge is possible. If the external world had no existence we would have no perceptions, and if we possessed no *a priori* notions our perceptions could not be combined so as to form an understood whole. Though cognition (knowledge) is the union of these two elements, yet we do not know things as they are in themselves, partly because of the forms native to the mind (categories, of which he enumerates twelve), which are necessarily productive of some change in the objects; and partly because our perceptions themselves are modified in their transit through the subjective mediums of time and space, which are the universal forms of all objects of sense: whatever is to be perceived must be perceived in time and space. In his practical philosophy he seeks to show that consciousness reveals to us the autonomy of the will, expressing itself in the supremacy of conscience, which is the categorical imperative of duty. This moral nature implies freedom as its necessary condition; the existence of God, as otherwise there would be a law without a law-giver or judge; and the immortality of the soul for the completion of our moral existence. These truths, the postulates of the practical reason, lie beyond the bounds of actual science, but are the undemonstrable necessities of a rational faith. The ablest opponent of the Kantian philosophy, Jacobi, took the stand-point of faith in opposition to that of criticism, in order to give theoretic certainty to the postulates of the practical reason. The absolute, which is unattainable by the reason, may be grasped by feeling, which gives immediate knowledge requiring no other evidence. In his later writings he identified faith or intuition with the Kantian reason, claiming for the latter the faculty of objective knowledge. In the hands of Fichte, who was the direct successor of Kant, philosophy was made to assume a purely idealistic aspect. The critical idealism of Kant becomes absolutely subjective idealism. 'All that is, is ego; this is the principle of the Fichtian system. The world is not only phenomenal, but is a hypothesis of the absolute ego. 'We know nothing,' says he, 'but by consciousness; consciousness is but a phenomenon; the images present to us are formed of images and by images; all reality is changed into a wondrous dream, without a life to dream of and without a mind to dream, a dream composed of a dream of itself. Perception is a dream; thought is the dream of that dream.' Fichte's subjective idealism found its continuation in the objective idealism of Schelling and the absolute idealism of Hegel. Schelling (1775-1854) started from the ego of Fichte, and by a combination of the doctrine of the ego with Spinozism transformed it into the system of identity. Object and subject, real and ideal, nature and spirit, are identical in the absolute, and this identity we perceive by intellectual intuition. In nature, which is the negative pole of being, there resides a vital principle—the soul of the world—which unites all organic and inorganic in one complete organism. In the development of spirit, which is the positive or ideal pole of being, there are three stages, theory, practice, and art, or the reduction of matter to form, the introduction of form into matter, and the absolute interpenetration of form and matter. Schelling subsequently, by successively incorporating into his system various opinions from Bruno, Bohme, and others, developed a syncretistic doctrine which constantly approximated to mysticism, and

exercised far less influence on the development of philosophy than the original system of identity. Hegel (1770-1831), developing this principle of identity, created the system of absolute idealism. In his philosophy he aims at elevating consciousness to the stand-point of absolute knowledge, and systematically developing the entire contents of this knowledge by means of the dialectical method. The principal stages in the development of human consciousness, from the stage of direct, unreflecting, unquestioning certainty, through the different forms of reflection and self-alienation up to absolute cognition, are consciousness, self-consciousness, reason, ethical spirit, religion, and absolute knowledge, the object of which is the movement of spirit itself. Absolute knowledge recognizes thought and being as identical. Finite things have the ground of their being not in themselves, but in the universal divine Idea. The absolute reason is revealed in nature and spirit: it alienates, externalizes itself in nature, and returns from this its self-estrangement in spirit. Spirit is the idea having emancipated itself from nature, and waked to consciousness in man; and it is by this awaking that the universe as such is produced, since thought and existence are identical. The perfection of spirit is in revealed religion or absolute philosophy, in which the conscious idea attains to universality, and reproduces from itself the whole natural and intellectual universe. Schleiermacher (1768-1834) modified the Kantian philosophy, attempting to do equal justice to the realistic and idealistic elements contained in it. The totality of all existing things is the universe; the unity of the universe is the Deity, with reference to whom man has a feeling of absolute dependence. In this feeling religion has its root. In place of Kant's too narrow conception of duty, by which the specific and variable are sacrificed to the universal, he substitutes the doctrine that each man's duty varies according to his individuality. In the highest good, which he defines as the supreme unity of the real and the ideal, Schleiermacher finds the ethical end of man, in duty the law of advancement towards this end, and in virtue the moving force. Schopenhauer (1788-1860) developed a doctrine which may be described as a transitional form from the idealism of Kant to the realism at present prevalent. In opposition to Fichte's subjective idealism, and to Schelling's renewed Spinozism, Herbart (1776-1841), on the basis of the realistic element in the Kantian philosophy, as also of Eleatic, Platonic, and Leibnizian doctrines, developed a philosophical doctrine, which he himself denominated realism, from its predominant character. After the death of Hegel, amongst others, Feuerbach, Richter, Strauss (died 1874), Bruno Bauer, and Arnold Ruge developed, in an extreme manner, Hegelian thought. Beneke (1798-1854), in opposition to Hegel and to Herbart, developed, on the basis of certain doctrines of English and Scotch philosophers, a psychologico-philosophical doctrine, resting exclusively on internal experience. During recent years in Germany Hegelianism has counted more adherents than any other system. Next to it has stood the Herbartian school; and more recently the modification of systems through a return to Aristotle or Kant, and the study of philosophy upon its historic side, have occupied the larger number of minds. The teachings of Schopenhauer and Beneke, as also of Krause, Baader, Günther, and others, have been reproduced and modified by individual disciples. Materialism is represented by Vogt, Moleschott, and Büchner, and sensualism in Czolbe and others. While resting in part upon the basis of the doctrines of earlier thinkers, Trendelenburg, Fechner, Lotze, and others have advanced in new and peculiar paths. The doctrines of H. Ritter,

Carus, Weisse, the younger Fichte, Nietzsche, and others also merit attention.

Though philosophy of late years has nowhere been cultivated to such an extent as in Germany, other countries have made no inconsiderable contributions to philosophical science. In France two philosophical tendencies opposed the sensualism and materialism so universal at the beginning of the nineteenth century. Of these one was theosophical, and the other found expression in the eclectic and spiritualistic school which was founded by Royer-Collard as the disciple of Reid, which was further built up by Cousin, who incorporated into its body of doctrines a number of German philosophemes, and in which the Cartesian tradition was renewed. Less brilliant than Cousin, but possessing no small merit as a thinker, Jouffroy attempted to unite the philosophy of his predecessor Maine de Biran to that of the Scottish school, and became associated with the spiritualistic school, to which also belong the names of Garnier, Janet, Rémusat, Franck, Jules Simon, and others. This school has contended valiantly against the pantheistic tendencies of the age. Independent systems are those of Pierre Leroux, Lamennais, Jean Reynaud, and Buchez. Materialism has its supporters in Cabanis, who sees in thought only a secretion of the brain, Broussais, Gall, and others. Positivism, founded by Auguste Comte, numbers not a few followers on the Continent and in England. The chiefs of another school, founded on the basis of Kantian criticism, are Renouvier and Pilon.

In Great Britain the Scottish school had later exponents in Sir James Mackintosh (1765-1832) and Sir William Hamilton (1788-1856), the last-named being, moreover, largely influenced in some points of his psychology by Kant. Our knowledge, according to Hamilton, is conditioned by our faculties; we have no faculty for comprehending the infinite and absolute; and all human philosophy, therefore, treats only of the relative and phenomenal. The absolute, as unknowable, is transferred from the province of philosophy to that of religion, from reason to faith. Mansel and McCosh may be mentioned as disciples of Hamilton. Ferrier (1808-64) assumed a polemical attitude towards the common-sense school in respect of its fundamental peculiarity, as he viewed it, of absorbing philosophy into psychology as well as on minor details of the system. The associational psychology of Hartley, Priestley, and Dr. Darwin has its representatives in the nineteenth century in James Mill (1773-1836) and his son John Stuart Mill (1806-73), who make the principle of association the sole explanation of psychical phenomena. Bain, Grote, and Lewes follow more or less in the same track. Herbert Spencer has attempted to widen the psychological principles of the associational psychology into a universal doctrine of evolution, which should not only provide for the evolution of all forms of being but also of the fundamental principles of philosophy itself. T. H. Green, J. and E. Caird, and W. Wallace have been exponents of the Hegelian philosophy. In America, as in England, philosophy has been prosecuted more as an applied science, and in its special relations to morals, politics, and theology. Speculation there has been widely influenced by Scottish philosophy. Among the best-known names of transatlantic philosophical writers are those of Jonathan Edwards, Henry P. Tappan, Asa Mahan, Theodore Parker, Noah Porter, and others. A modified scholasticism, mostly Thomism, prevails in the Catholic seminaries of France, Spain, and Italy. In most of the continental countries German philosophy has exerted no small influence. In Italy a peculiar philosophical school, represented by Rosmini, Mami-

ani, and Gioberti, flourished during the nineteenth century. Gioberti and Rosmini have been characterized as the Plato and Aristotle of modern Italy. The former developed a philosophy that was designed to reconstruct all modern science and society. He starts with the intuition of real being, of the active Deity, as the absolute source of existence. Philosophy is founded on revelation and perpetuated by the church, which is the depository of truth and source of civilization. According to Rosmini philosophy is the science of the ultimate reason; the product of highest reflection, it is the basis of all sciences in the universal sphere of the knowable, embracing ideality, reality, and morality, the three forms under which being manifests itself. Mamiani advanced the doctrine that immediate perception is the only foundation of the knowledge of reality. The Italian school is remarkable for its *à priori* method and its respect for ecclesiastical and national tradition. For the Italian philosophers of the middle ages see ITALY, section dealing with Italian Literature.

More information regarding the history of philosophy will be found scattered throughout this work in the biographical notices of individual philosophers as well as in the sketches of the different schools of philosophy. Reference may be made to the following works:—Ritter, *Geschichte der Philosophie* (twelve vols. Hamburg, 1853); Schwegler, *Geschichte der Philosophie* (Stuttgart, 1848; translated by J. H. Stirling, with annotations, second edition, 1868); Cousin, *Cours de Philosophie Morale* (1841); Lewes, *Biographical History of Philosophy* (5th edition, two vols. 1878); Ueberweg, *Grundriss der Geschichte der Philosophie* (new edition, 1897; English translation, two vols. 1872-74); Erdmann, *Grundriss der Geschichte der Philosophie* (4th edition, 1895; English translation, two vols. 1889); Bergmann, *Geschichte der Philosophie* (two vols. 1892-93); Hoffding, *Geschichte der neuern Philosophie* (English translation, 1900); Von Hartmann's *Geschichte der Metaphysik* (1899); Willmann's *Geschichte des Idealismus* (1898); Lange's *History of Materialism*, &c.

PHILOSOPHY, PERIPATETIC. See PERIPATETIC PHILOSOPHY.

PHILOSTRATUS, FLAVIUS, the Elder, a distinguished Greek Sophist and rhetorician, born at Lemnos about the middle of the second century of our era. Few facts regarding his life have come down to us. All we know is that he taught rhetoric at Athens, and subsequently at Rome, where he obtained the favour of the emperor Septimius Severus, and was received into the circle of *literati* that the empress Julia Domna had gathered around her. He accompanied this princess in her travels. His principal work is his *Life of Apollonius of Tyana*, undertaken at the desire of the empress, and which some critics have supposed to be a parody on the Gospels. His other works include the *Heroica*, dealing with Trojan war; the *Eikones*, a description of certain paintings the author had seen at Naples; *Vitæ Sophistarum*, or the lives of several of the Sophists; *Letters*; &c. Among the editions of his collected works are those of F. Morel (Paris, 1709) and Kayser (Leipzig, 1870-71).—PHILOSTRATUS, the Younger, a nephew of the preceding, was likewise a Sophist and rhetorician, but in every way inferior to his uncle, whom he rather servilely imitates in his *Imagines*.

PHILTRE, a love potion. From the earliest times it has been supposed that there were means by which love could not only be excited but be directed to a particular object. Various substances from the animal and vegetable kingdoms have been used for this purpose, some disgusting, some injurious, some without any distinguishing character. The truth is, that

physical desire may be produced by physical stimuli, which are called *aphrodisiacs*, but it is absurd to suppose that such means can produce a passion for a particular object.

PHLEBITIS (Greek *phleps*, *phlebos*, a vein), inflammation of the veins. It may begin outside of the vein, owing to some wound, abscess, &c., in the neighbourhood, from which matter or other irritant material travels upwards in the loose connective tissue forming the bed of the vein. In such a case the inflammatory process, though beginning outside the vessel, invades its several coats, disturbing their nutrition, and reaching the inner coat, where it causes cloudy swelling and roughness of the smooth surface. On this roughened surface the blood within the vessel tends to coagulate in layers, and this may form a clot large enough to block the vessel. On the other hand the inflammation may begin from within the vessel, owing to a clot forming on its inner wall, which, acting as an irritant, excites inflammation in the coats of the vessel from within outwards. In the former case the formation of matter is likely to occur around the vessel, and parts of the clot, which is soft and loose, are apt to become detached and carried by the circulation to other parts, setting up similar changes there. In the latter case the vessel is likely to be obliterated and converted into a fibrous cord. The disease is indicated by great tenderness, tension, acute pain, and a knotted, cord-like swelling or hardness in the course of a vein or veins, sometimes attended, when the veins are superficial, with discoloration of the surface. Dropsical swelling of the affected part, and in some circumstances, when, for instance, a main vein is affected, of a whole limb may occur. A disease, called *phlegmasia dolens* or white-leg, commonly associated with phlebitis of one lower limb, is frequent in women after confinement.

Phlebitis may be prevented by taking great care in the dressing of wounds applying such a dressing as will keep the wound clean and healthy. The treatment recommended for this disease is very various, and should in all cases be conducted under qualified direction. The patient must be kept perfectly quiet, to diminish the risk of clots becoming detached. Good nourishing food should be given, and the administration of tonics will prove a great advantage. In some cases the use of stimulants is recommended. Abscesses within reach require opening. Veins may also become inflamed owing to over-pressure of the blood within them producing dilation. The veins are then described as *varicose*, and when in this state they generally become tortuous. See **VARICOSE VEINS**.

PHLEBOTOMY, in medicine, the act of letting blood by opening a vein. Among the ancients great regard was had to the place where the opening was to be made. At the present day when the operation is performed, which is but seldom, one of the superficial veins just at the bend of the elbow is usually selected. The operation itself was anciently performed with a spring lancet, now for the most part with a simple lancet. Of the arteries, that of the temples is the only one which is opened, and that is done in cases of local complaints of the head. Another mode of letting blood is by cupping, or by the application of leeches for the purpose of extracting blood from places affected by inflammations. Phlebotomy used to be regarded as a most valuable method of treatment, but it has fallen into almost complete disuse. Hippocrates rarely resorted to it, for he considered the cure of fevers and inflammations as the work of nature, and regarded phlebotomy as a mode of weakening the efficacy of her operations. His followers applied it more frequently, sometimes

even to excess. The schools of the empirics (250 B.C.), relying, like Hippocrates, on their own experience and on the observation of nature, endeavoured to determine the cases in which bleeding was indispensable. But medicine declined with the general decline of science. Greek physicians indeed still distinguished themselves among the Romans, but the sect of empirics had degenerated. Excessive bleeding again became common, until Asclepiades of Bithynia (Cicero's physician and friend) taught a new method of phlebotomy. He considered the cause of the greatest number of diseases to be redundancy of blood, and on this account advocated the practice of bleeding, but principally for the alleviation of pain, and applied this remedy frequently in case of local affections. After him Celsus gave an account of the cases in which bleeding was necessary (A.D. 5), and his remarks and directions correspond exactly with those of the greatest modern practitioners. Aretæus, founder of a new school (A.D. 70), prescribed bleeding more frequently in acute than in chronic diseases, and in extreme cases he bled the patient to complete exhaustion. Galen (160), who referred the origin of a large class of diseases to excess of blood, ordered copious bleedings; and this practice gained great repute, and prevailed for several centuries. After the fall of the Roman Empire physicians were so scarce in Europe that Charlemagne is said to have died of an inflammation of the lungs, for want of medical attendance. The Arabian physicians followed the authority of Galen, and spread his doctrine over Spain, Italy, and France. Bleeding was still more generally practised by the monks, who were in the sole possession of medicine as well as of all other science in those ages. At a later period astrology was connected with the medical art, and bleedings were prescribed on certain days. The popes, indeed, had often forbidden the monks to practise medicine; but they either disregarded the orders, or considered them as referring only to surgical operations. Thus surgery began to be separated from medicine, and formed a new profession, including the art of bleeding, applying leeches, and shaving. But when, after the invention of printing, the writings of the physicians of Greece, especially of Hippocrates, began to circulate and their doctrines to revive, the practice of bleeding, at least among physicians, was again confined to certain cases. In Germany Paracelsus (1525) overturned the system of Galen, and with it the practice of bleeding, which was now confined to the surgeons and barbers alone. In France, Italy, &c., the method of Hippocrates and the degenerated system of Galen were, however, not yet abandoned, and the practice of bleeding was carried to the greatest excess. Helmont (1600), the founder of a new system, doubted the use of extracting blood, alleging against it that it weakened too much the vital spirit, which he called *archæum*. Harvey's discovery of the circulation of the blood (1619) had some influence on the modes of phlebotomy, in as far as it led to experiments (1642) by which medicines were infused immediately into the veins, or a portion of the infected blood extracted, and supplied by the blood of healthy men or animals. In England Sydenham rose (1673), who thought it possible to expel diseases by copious bleedings. He extracted blood in almost all cases, never less than 8 oz., generally 10 or more, and in cases of inflammation as much as 40 oz. The pernicious consequences of this practice did not escape him, but he thought he could not subdue disease by any other means. Stahl (1707) attempted to unite the system of Hippocrates with that of Helmont, and advocated the more moderate practice of phlebotomy. He taught that abundance of blood was no disease, but might become so by a disproportion-

tion created between the solid and fluid parts of the system, in which case the proper balance ought to be restored. But he found bleeding indispensable in cases of too great excitement succeeded by a congestion or effusion of blood. To prevent this he prescribed occasional bleeding. His method was soon misunderstood and misapplied. The extraction of blood for the preservation of health was everywhere thought necessary. Borden endeavoured to stop this abuse in France. Cullen (1777), who regarded all diseases as proceeding from an unnatural state of the nerves; all irregularities of the fluids as the consequences of weakness and spasm, recommended bleeding as the best means to diminish the activity of the whole body, and especially of the system of the blood-vessels. He recommended, however, a due regard to circumstances, and mainly adopted Stahl's doctrine of the superabundance of blood. Stoll of Vienna (1780), an admirer of Sydenham, resorted frequently to bleeding. Several of the later physicians sought, however, to limit its too frequent application. Wollstein (1791) recommended it only in a few cases. Gall also improved the system still more. Brown adhered to the same maxim, and greatly limited the practice. At present the belief is gradually growing that the practice might in some cases be employed with great advantage.

PHLEGETHON, in the Grecian mythology, a river of fire in the infernal regions. See COCYTUS.

PHLOGISTON. This name was applied, before the time of Lavoisier, to a hypothetical substance supposed to be contained in all combustible bodies. See OXYGEN and CHEMISTRY.

PHLOX (Greek, *phlox*, flame, referring to the bright colour of the flowers), a genus of herbaceous plants of the natural order Polemonaceæ, natives for the most part of North America, though some of the species are to be met with in Asia. The leaves are generally simple, entire, sessile, the lower ones opposite, and the upper ones alternate; the flowers are of a purple or violet colour, more rarely white or red. The corolla is salver-shaped, with a narrow sub-cylindrical tube, and longer than the calyx, which latter is deeply five-cleft and sub-cylindrical or sub-prismatic. The genus is perennial, and a great favourite with florists.

PHOCA. See SEAL.

PHOCAS, a Greek emperor, born in Asia Minor of obscure parentage, entered the army in the reign of Mauricius, and rose to be a centurion. While on the banks of the Danube he took a lead in one of the mutinies then of so frequent occurrence, and set out at the head of the disaffected on their march to Constantinople. Their approach compelled the emperor and his family to save themselves by fleeing to Chalcedon. Phocas took possession of the throne, and was formally crowned in 602. Mauricius, with his five sons, and shortly after all the members of his family, were cruelly butchered. Phocas immediately attempted to open a negotiation with the Persian monarch Khosru II., but the nature of his usurpation and the atrocities attending it caused his advances to be treated with disdain, and the Persians immediately came forward as the avengers of Mauricius and his family. The war thus inaugurated continued for twenty-four years, during the first eighteen of which the Persians were uniformly successful. But the Roman court was not so scrupulous as the Mohammedan court had proved; and Pope Gregory I. not only recognized the legitimacy of Phocas, but addressed a series of complimentary letters to him and his wife. The end which the pope had in view no doubt seemed to him to justify the means, and the infamy incurred by writing the letters was thought to be more than compensated

by the liberal donations expected, and to some extent actually obtained from Phocas. Boniface III. and IV., the immediate successors of Gregory, pursued the same policy; and if we can believe the Papal chronicler Anastasius, this atrocious imperial usurper formally acknowledged the pope to be the head of all Christian churches. Vengeance had lingered long, but it at last overtook him. Heraclius, exarch of Africa, fitted out a powerful armament by sea, and at the same time sent a powerful army by land, the one commanded by his son Heraclius, and the other by his nephew Nicetas. The combined forces met before Constantinople, which made but a feeble resistance, disaffection within giving powerful aid to the assault made from without. Phocas was among the captives, and ended his life in 610 by a death as cruel as those which he had inflicted. The younger Heraclius immediately took possession of the vacant throne.

PHOCION, an Athenian general, and one of the most virtuous characters of antiquity, is supposed to have been born about B.C. 402. Though of humble descent, he received a good education, and imbibed under Plato and other philosophers those elevated sentiments which governed his whole life. He first served under Chabrias, and his activity contributed essentially to the naval victory of Naxos (377 B.C.) In the war with Philip of Macedon the Athenians sent Phocion with some troops to Eubœa, where he obtained a complete victory over the enemy. He banished Plutarchus, who had made himself tyrant of Eretria, and left the island secure from the attacks of Philip. Some time after he was despatched by the Athenians to assist the cities of the Hellespont against Philip, whom he compelled to retire. His honesty, disinterestedness, and patriotism were so generally acknowledged that he was nominated commander forty-five times without once applying for the office. He always led a simple life, and cultivated his small farm with his own hands. When Philip appeared in Phocis with a view to attack Attica, Phocion in vain advised peace. The battle of Cheronea in 338 proved the soundness of his advice. The Athenians disregarded the advice of Phocion not to take part in the assembly of the Grecian States, convened by Philip, till they knew the intentions of the king, and in consequence found themselves obliged to furnish Philip with a quota of cavalry and galleys. This they were reluctant to do, but Phocion advised them to submit to adversity with patience. After Philip's death in 336 Phocion advised the Athenians not to expose themselves to new disasters by joining a confederacy against the young Alexander. His opinion was justified by the event. When, after the destruction of Thebes, Alexander demanded of the Athenians the deliverance of the orators who had spoken so violently against him, Phocion undertook the commission of appeasing the anger of the king with the happiest success. Alexander conceived a great affection for him, and sent him a present of 100 talents, which he declined. The deputies found him carrying water, while his wife was baking bread. But not to displease the king, he requested the liberation of some of his imprisoned friends, a request which was at once complied with. After Alexander's death in 323 the project was formed of freeing Greece from the Macedonian yoke. Phocion disapproved the measure, though he accepted the command. The Athenians were at first successful; but Antipater soon obtained the superiority, and threatened Athens, which was instantly abandoned by the orators who had been so clamorous for war. Phocion succeeded in obtaining peace, but on very hard conditions, and all his efforts were directed to mitigate the heavy burdens of his

country, and to turn his influence with the Macedonians to its advantage. Nevertheless Phocion was accused of having acted against the good of his country, and of having betrayed it to the enemy. He was compelled by clamours and accusations to take refuge in Phocis, but was delivered up to the Athenians by Polysperchon. Phocion, with several of his friends, was condemned to death unheard. His calmness continued unshaken. 'Tell my son,' said he to a friend who asked if he had any commission for him, 'to forget that the Athenians have been unjust to me.' When many had drank the fatal draught, it was observed that there was not enough remaining for the rest, and the officer who administered it refused to procure more without pay. Phocion requested a friend to pay him, and said jestingly, 'It is not even allowed us to die gratis in Athens.' His body was thrown unburied beyond the limits of Athens, but his friends carried it to Eleusis, and burned it in the house of a Megarensian woman. The Athenians became sensible of their injustice; they procured his remains, buried them at the public expense, erected a monument to his memory, and punished his accusers.

PHOCIS (Greek, *Phōkis*), a division of ancient Greece, bounded on the north by the Locri Epizephyrii and Opuntii, on the east by Boeotia, on the west by the Locri Ozolæ and Doris, and on the south by the Gulf of Corinth. The principal rivers were the Cephissus and Plistus, and the principal mountain Parnassus. Phocis was a mountainous and unproductive country, the valley of the Cephissus being almost the only fertile tract in it. According to tradition the earliest inhabitants were the Leleges, Thracians, Abantes, Hyantes, and subsequently the Phlegyæ, an Achaean tribe. The Phocians are said to have derived their name from Phocus, son of Ægeus, who conducted hither an Ægean colony. They were an industrious people, and subsisted chiefly by agriculture. They were distinguished for their bravery, of which they gave a signal proof in the war with the Thessalians, and in the Persian and Peloponnesian wars, in which last they took part as allies of the Spartans. They were the cause of the Sacred war, so destructive to Greece, and shared the general fate of their countrymen after the battle of Chæronea (B.C. 338). See GREECE (ANCIENT).

PHŒBUS. See **APOLLO**.

PHENICIA (Greek, *Phoinikē*; Latin, *Phœnice*, and later *Phœnicia*), a country on the coast of Syria, bounded on the east by Mount Lebanon. Various derivations have been assigned to the Greek name. Some would take it from the eponymous *Phœnix*, son of the first king Agenor; others from *phoinix*, the palm-tree; others from *phoinix*, the purple dye, which formed an important article of Phœnician commerce; while others again, from the old tradition that the Phœnicians came from the Red Sea, regard *phoinix* as but the rendering of *eruthros*, 'red,' the epithet given to the Arabian Gulf, and in Herodotus to the northern portion of the Indian Ocean. By the Phœnicians themselves, and by the Israelites, the country was called Chna or Canaan, which signifies the 'low country' or lowlands, in contrast to the eastern 'heights,' at the base of which it was situated. Canaan, however, came generally to signify the whole country of Palestine, in relation to the mountains or table-land of Gilead and Aram—the highland region to the north and east. The expression 'Tyre and Sidon' often represents the whole country of Phœnicia.

Phœnicia in its narrowest acceptation, or Phœnicia proper, was a tract of country stretching along the eastern shore of the Mediterranean: not much more than 28 miles in length, and little more than 1 mile in

average breadth; Sidon being situated near its northern, and Tyre not far from its southern boundary. In its widest sense, as in Strabo, Phœnicia seems to have meant the whole seaboard from the Gulf of Issus to the southern desert—'from Orthosia to Pelusium'—a length of 450 miles (Geog. xvii. 11, 20). But generally Phœnicia was regarded as beginning at the north with the Island of Aradus, and extending south to the town of Dora, a little below the promontory of Carmel; being about 120 miles in length, and rarely more than 20 in breadth; lying about lat. 32° 38'—34° 52' N., and lon. 35°—36° E. It is watered by several streams flowing from the western declivities of Lebanon to the sea; such as from its northern frontier and in order southward, the Eleutherus, the Ailonia, the Lycus, the Tamyra, the Bostrenus, the Leontes, and the Belus. The country, with its varieties of climate, was fertile; pine, fir, cypress, cedars, terebinth, sycamores, fig, palm and olive trees, and acacias crown the heights; on the lower regions are found wheat, rye, and barley, together not only with ordinary fruit, but also with apricots, peaches, pomegranates, almonds, citrons, sugar-canes, grapes, bananas, all growing luxuriantly, and forming a forest of finely tinted foliage. The lowlands further yield silk, cotton, indigo, and tobacco. The only metal found is iron, which occurs in considerable quantities in the hills above Beyrout (the ancient Berytus). The whole country is subject to earthquakes, the effect of volcanic agency. Besides the great cities of Sidon and Tyre, the country was studded with numerous smaller towns; 'forming,' as Heeren says, 'almost an unbroken city, extending along the whole line of the coast, and over the islands.' Among these towns in earlier times were Arvad, Accho, Orthosia, Arka, Tripolis, Botrys, Berytus, Sarepta, Dora, &c. Many of the roadsteads or harbours were excellent, but are now silted up by the currents which carry the alluvial soil brought down by the Nile to the eastward.

The question of the origin of the Phœnicians has as yet received no satisfactory solution. According to Herodotus they described themselves as immigrants from the shores of the Erythraean Sea, a report confirmed by Justin. Strabo writes that in the Persian Gulf there were two islands called Tyros or Tylos, and Aradus, with a town named Dora, in which there were temples similar to those of the Phœnicians, and the inhabitants of those places related that the Phœnicians had quitted them to found new colonies. The Erythraean Sea, in its widest sense, includes the Red Sea, the Persian Gulf, and the northern part of the Indian Ocean confined between the eastern shores of North Africa and the western shores of Hindustan; and as the writer of Genesis calls Canaan the son of Ham the founder of the race, some investigators have concluded that the Persian or Arabian Gulf is the original home of this people. Against such conjectures, however, important arguments have been adduced from the genuine traditions of the Phœnicians themselves, as preserved, not in a corrupted Greek state, but in their myths, in the biblical accounts, and in their language, which in its most ancient forms is purely Semitic. Their immigration to the coast of the Mediterranean belongs to prehistoric times. The probability is that it did not take place from one region or at one time, and that many centuries elapsed before they were fused into one nationality. The settlement of Israel in Canaan did not produce any great or permanent change on Phœnicia. The tribes of Naphtali, Asher, and Dan, to which it was assigned, did not conquer Phœnicia, but occupied only a small portion of it. The canton of Dan reached to Joppa, and in the struggle with Jabin he remained

'in his ships,' as if made effeminate and worldly by commerce. Asher, who had obtained a partial footing, had also lost patriotic spirit, and 'abode in his breaches' (creeks). The relation of Israel to Phœnicia was quite different from that of Israel to Philistia—the latter being that of continuous feud, alternative conquest or armed peace; the other becoming one of amity, intercourse, reciprocal advantage, and 'brotherly covenant.' Such alliance was not indeed unbroken, for we read of early Sidonian oppressions. But at a later period 'Hiram,' king of Tyre, was 'ever a lover of David;' and in the reign of Solomon the servants of Hiram prepared cedar and fir wood for the temple, hewing the trees in Lebanon, and conveying them by sea 'in floats;' while Solomon in return gave him, 'year by year, twenty measures of wheat and twenty measures of pure oil'—food so abundant in the one country being given in exchange for skilled labour which the other could so easily furnish. The Phœnicians, alive to their true interests, sought to colonize and not to conquer. Wars would have been fatal to their commercial prosperity. Their wealth and power arose from their command of the sea, and it was their policy not to provoke any of the nations to the east of them, and not to quarrel unnecessarily with Israel—which was their granary—the relation between Hiram and David being probably but a sample of such international treaties and intercourse. After David had conquered Edom, Ezion-geber on the Red Sea became a Hebrew port, and 'Solomon had a navy of ships.' As the Hebrews had not been trained to navigation, they took advantage of their neighbours' experience, and Phœnician crews partially manned each of their vessels, for 'Hiram sent in the navy his servants, shipmen that had knowledge of the sea, with the servants of Solomon.' The result was a sudden and great accession of wealth and luxuries—the navy of Tarshish returned every three years bringing 'gold and silver, ivory, and apes, and peacocks,' so that 'silver was nothing accounted of in the days of Solomon'—nay, it was 'made to be in Jerusalem as stones.' After the division of the Hebrew kingdom Phœnicia would naturally cultivate alliance with the Ten Tribes nearest to it, and Ahab married a Phœnician princess. The joint commercial voyages probably were not prosecuted during any long period, as the Jews had no liking for the sea. Indeed, the trade seems to have been abandoned for some time, when Jehoshaphat attempted to restore it. Ahaziah, on the strength of old traditions, and because of his mother's Phœnician connection, sought a share in the enterprise, and was at first refused. Afterwards the refusal seems to have been modified, and a partnership was admitted, on account of which the enterprise was frustrated. The history of Phœnicia in its special points, its commerce, and the invasions which it suffered from Babylon, Persia, and Greece will be best considered under Sidon and Tyre (which see).

Herodotus describes the Phœnicians as beginning soon after their settlement to occupy themselves in distant voyages. From the construction of rude rafts they must speedily have reached to a style of substantial ship-building. Their commercial vessels are represented either as long in shape, and fitted both for sailing and being rowed with fifty oars—'ships of Tarshish;' or as rounder in form and more capacious in stowage, but slower in speed—bearers of cargo on short voyages. Xenophon passes a high eulogy on a Phœnician ship—'the greatest quantity of tackling was disposed separately in the smallest stowage.' Their merchantmen also carried arms for defence, and had figures on their prow, which the Greeks named *patarkoi*. They steered by the Cyn-

osure, or the last star in Ursa Minor; and they could cast reckonings, from the combined application of astronomy and arithmetic. This nautical application of astronomy is ascribed by Callimachus to Thales, a Phœnician by descent. Lebanon supplied them with abundance of timber, and Cyprus gave them all necessary naval equipments, from the keel to the top-sails. These daring Phœnician navigators in the reign of Pharaoh-Necho circumnavigated Africa—departing from the Red Sea and returning by the Straits of Gibraltar. They reported that in sailing round Libya they had the sun on their right hand—a story of which Herodotus says, 'I, for my part, do not believe them,' and yet it is the positive proof that they had gone round the Cape. Diodorus speaks also of Phœnician mariners being driven westwards beyond the Pillars of Hercules into the ocean, and reaching at length a very fertile and beautiful island—'a dwelling of gods rather than of men'—one probably of the Azores or Canary Islands. The Phœnicians furnished to Xerxes 300 ships, but they were defeated at Salamis.

The remote periods of Phœnician commerce and colonization are wrapped in myths. Phœnician ships may have first carried the produce of Assyria and Egypt—but their own wares and manufactures were soon largely exported by them. The commerce of Tyre reached through the world. (See TYRE.) It traded in the spices, cinnamon, and stones of Arabia; in the myrrh and frankincense of Sabæa; in ivory, ebony, 'bright iron,' and cotton fabrics from India; in linen and corn from Egypt; in wine and wool from Damascus; in embroideries from Nineveh and Babylon; in wheat, balm, and oil from Judæa; in pottery from Attica; in skins of lions, panthers, and elephants from Mauritania; in horses and chariots from Armenia; in copper and its mixtures from the coasts of the Euxine; in lead and other metals from the south of Spain; and in tin from the coasts of Cornwall and Devonshire. There was also a great trade in the tunny fisheries, and the Tyrians sold fish in Jerusalem. Phœnicia excelled in the manufacture of the purple dye extracted from the shell-fish murex, so abundant on parts of its coasts. This colour in its richest hue was at length appropriated to imperial use, and the silk so dyed was of extraordinary value. The glass of Sidon was no less famous than the Tyrian dye—the fine white sand used for the process being very abundant near Mount Carmel. Glass has been found in Nineveh, and glass-blowing is figured at Beni-Hassan in Egypt. The art might have come from Egypt, but the discovery in Phœnicia is represented as accidental. The pillar of emerald shining brightly in the night, which Herodotus speaks of as being in the temple of Hercules, was probably a hollow cylinder of glass with a lamp within it. Phœnicia produced also drinking cups of silver and gold. Homer describes Sidon as abounding in works of brass. Its building stone was not of very good quality, but cedar-wood was largely employed. When stone was used the joints were bevelled—a practice which also characterizes Hebrew architecture, and gives it a panelled appearance. The mining operations of the Phœnicians were also celebrated. Herodotus says that they turned a mountain over in the search for gold. Mines were wrought in the various colonies—in the Grecian islands and in Spain—by processes much the same as those employed in more modern times.

The marine knowledge and experience of Phœnicia led to the plantation of numerous colonies in Cyprus, Rhodes, Cilicia, and the islands of the *Ægean*—the Cyclades and Sporades—in Sicily, in Sardinia, the Balearic Islands, and in Spain. Strabo says that the Phœnicians possessed the best parts of Iberia

before the days of Homer. One principal colony was in Northern Africa, and Strabo asserts that they occupied the middle part of Africa soon after the Trojan war. The story of Dido and the foundation of Carthage is well known, the event being generally placed between 800 and 900 B.C., though some place it as early as before 1200 B.C. Byrsa, the name of the hill on which the city was built, denotes a fortress, being Bozrah, the name also of the Idumean capital; though its Greek form gave rise to the story about the purchase of as much land as a hide would measure. Carthage means 'new town,' and Punici is only another spelling of Phœnici. Intercourse with many strange and untutored races led the Phœnicians to indulge in fictions, and love of gain taught them mercantile deceptions and stratagems. 'Phœnician figment'—*psœuma phoinikikon*—or a traveller's tale, was proverbial in former times, like *filæ Punica* at a later period. The *Etymologium Magnum* bluntly defines *phoinikikon* by *to pseudos*, the lie. In the *Odyssey* they are described as 'crafty,' or as 'crafty and wicked.' As a trading nation they were ready sometimes to take advantage of the ignorant and savage tribes with which they bartered, and they cared nothing for law or right on the high seas, where no power could control or punish; so that Ulysses uses the phrase *Phoinix anēr apatēlia eidōs trōkētēs*, 'a Phœnician man knowing deceitful things—crafty.' They were often pirates; they were certainly slave-traders. They purchased slaves from the northern shores of the Black Sea, and they also kidnapped and sold the children of Israel. This nefarious practice brought upon them the severest denunciations of the prophets, and a just retaliation was predicted to fall upon them. The terms 'Canaan,' 'Canaanite,' or 'man of Canaan,' the native name of the Phœnician, is sometimes rendered 'merchant' in the English version. 'Phœnician' and 'merchant' were thus interchangeable terms; so that in Greek *Phoinix ginomai* means, 'I become a trader.' But the phrase seems to have sunk in moral meaning, and trader was but another name for a hucksterer, or a pedlar going from house to house, as in Pro. xxxi. 24. Nay, the prophet Hosea says, 'He is a Canaanite,' or 'Phœnician,' or 'as for Canaan, the balances of deceit are in his hand: he loveth to oppress.' A common proverb expressive of fraud matching fraud was 'Syrians against Phœnicians.' No coined money of Phœnicia is extant prior to its subjugation by the Greeks. The standard seems to have been the same as the Jewish; the shekel being equal to the Attic tetradrachm; and the *zuz*, which occurs on the tablet of Marseilles, being of the value of a denarius. On the same tablet *keceph* (silver) occurs, with the probable ellipse of 'shekel,' as in Hebrew. Foreign silver money is also there referred to. Among the antiquities dug up in Nineveh are several bronze weights in the form of lions; having both cuneiform legends with the name of Sennacherib, and also Phœnician or cursive Semitic inscriptions. The *cor* was a Phœnician measure, the same as the Hebrew chomer, and holding 10 Attic metretres, each metretres being equal to about 10½ gallons. The arithmetical notation was carried out by making simple strokes for the units; ten was a horizontal stroke or a semicircle, twenty was represented by the letter N, and 100 was also a special sign, the unit strokes added to it denoting additional hundreds. The intercourse of the Phœnicians with so many distant countries gave new words to both Hebrews and Greeks. Such words expressing the objects in which they traded were a national importation. Thus in Hebrew we have *almug*, *shen-abbim*, *koph*, *tukkyim*—Indian or Sanskrit terms denoting the curiosities which Solomon's fleet brought back.

They also added to the tongue of the Greeks such terms as *murrha*, *kassia*, *hyssōpos*, *nardos*, *kinamōmon*, *bussos*, *kamēlos*, *arrhabōn*, (myrrh, cassia, hyssop, nard, cinnamon, yellow flax, camel, earnest-money), words which are only Greek forms of Phœnician ones; just as we have muslin, bayonet, damson, cordovan, and currant—names of things imported, and the names are now naturalized.

As was the case in Canaan at the invasion, each Phœnician city was governed by a king or petty chief. A powerful aristocracy existed in the chief towns, and may have formed a deliberative assembly on great occasions. There were also elective magistrates, called by the Romans *suffetes*, a disguised form of the Hebrew *suffit*; and two officers so named the Phœnician colony of Carthage placed annually at the head of their government. Sidon, and afterwards Tyre, exercised a hegemony over the other states; yet the jealousy of the three great towns was so keen that they met for consultation on common ground at Tripolis, where each of them had a district separated from the others by a stadium. The relation of Phœnicia to her colonies, so numerous and so distant, does not seem to have been, as indeed it could not be, very close. Thus we read that the Danites, when they sought them an inheritance, marching in an armed band, came to Lush, and took it so easily, 'because there was no deliverer, and it was far from Sidon.' Their religion, however, bound the mother country and the colonies in a common worship. Carthage often sent presents to the great god; so did Gades and other settlements.

While the wealth and commerce of Phœnicia must have brought art and refinement, the people, as has commonly happened, were noted for their dissoluteness. The Western World often traced its corruption to Phœnicia. Phœnician songs are stigmatized by Athenæus as rude and indecent, and *phoinikizōn* is one who is brutally lustful. Effeminacy and licentiousness sapped the natural power of self-defence, and led the Phœnicians to the employment of mercenaries. A rich and unwarlike people could not but lure the conquerors to an easy prey, and such came in succession from Assyria, Babylon, Persia, and Rome.

The religion of the Phœnicians was a species of nature-worship, the objects of adoration being the sun, moon, and five planets; or in another form it was the worship of male and female reproductive powers—the former represented as Baal and the latter as Baalith, Ashtoreth, or Astarte. The worship of Ashtoreth became as degraded and licentious as that of Mylitta at Babylon. Large troops of hierodulæ (prostitutes) ministered to the goddess. These ministers did not belong to one sex—there was the emasculated as well as the licentious. This impure and unnatural worship, so opposed in letter and spirit to the Mosaic law, was tolerated in the very vicinity of the temple. But the worship which was so licentious on the one side was inhuman and bloody on the other. The god called Il, a sort of Phœnician Cronos or Saturn, had human sacrifices offered to him. His image was of bronze, and, according to the description of Diodorus, resembled that of Moloch or Milcom, the god of the Ammonites, to whom children were sacrificed. After a triumph they also sacrificed beautiful captives. Their literature having perished it is impossible to arrive at any minute knowledge of Phœnician polytheism and its ritual. In some parts of the country they practised circumcision, though the rite does not seem to have been common among their nearest neighbours of the interior and the coast—the Canaanites and Philistines. Their cosmogony, as given in the remains of Sanchoniathon, is peculiar, and is ascribed to Taut—Thoth

or Hermes. From the wind, Kolpia (the voice of the mouth of Jah), and Baau, his wife, were produced the two first mortals; these had three sons, Light, Fire, and Flame, who produced a race of giants from whom the mountains—Cassius, Libanus, Brathy, &c.—were named, and who with their descendants discovered the various arts of life. In later times the gods were regarded as merely deified men, and this new mythology was absurdly enough grafted on the older cosmogony. Elyon (the Mighty One) and his wife Beruth are their progenitors, who dwell near Byblus. From Elyon descends Heaven, who weds his sister Earth, and begets four sons, Il, Betutus, Dagon, and Atlas. Heaven deposes his father, and kills his own son, Sadid, and one of his daughters. The sun and moon were revered in conjunction with Baal and Astarte. The proper name of Baal is Baalsamen, 'lord of the heavens.' This name Baal is compounded with many proper names—Ethbaal, Jezebel, Hannibal, Asdrubal; and with names of places, as Baal-gad, Baal-hamon, Baal-shalisha, showing the prevalence of his worship over the land even after the Hebrews had taken possession of it. Among a seafaring people marine deities must have held a prominent place—deities corresponding to Nereus and Poseidon, which last was worshipped at Berytus. The Cabiri (Strong Ones) presided over navigation, and are in many respects of similar rank and prerogative with the Dioscuri—the protectors of sailors. In the oldest temples there were no images; what Tacitus calls the *effigies humana* was absent. But there were rude fetiches—conical or oblong stones, the larger ones perhaps aerolites 'fallen from heaven,' and the smaller ones possibly fossil belemnites. Such a stone was called by the Greeks *baitulos*, and Bochart and others of a former age traced these to Bethel and to the pillar which Jacob erected there.

The language of ancient Phœnicia may be generally called Hebrew, or the language now commonly understood by that designation. Jerome and Augustine distinctly bear this testimony. According to the first the one tongue was *confinis* to the other; according to the latter almost all the words, *pene omnia*, of the two tongues were the same. The famous passage in the *Pœnulus* of Plautus illustrates the assertion. Act v. scene 1 contains in sixteen lines the Phœnician translation of the Latin text, with upwards of 100 Phœnician words. Several other phrases and words are found in the two following scenes. Phœnician or Punic words are quite intelligible from their relation to Hebrew. Thus Jerome says that in that tongue a virgin is called *almah*. Messias, according to Augustine, was Messe in Punic; and similar are Bel or Baal, Adoni, Malka, &c. Of ninety-four words on a tablet discovered at Marseilles in 1845 relating to the sacrificial ritual no less than seventy-four are found in the Old Testament. Coins and seals also disclose the same affinity as do the numerous inscriptions on stones found in many places in Cyprus, Malta, Sidon, Sicily, Sardinia, and Africa. Proper names can all be explained in the same way. Melkarth, called on a Maltese inscription the Tyrian Baal, is a compound of two words which in Hebrew signify king of the city. Hanno, one of the commonest Punic names, is from *han*, favour, grace, the same in meaning with Joannes, John; Anna, the sister of Dido, is the same as Hannah, mother of Samuel. Dido herself, 'his love,' is of the same root as David; Hannibal is the 'grace of Baal'; Asdrubal the 'help of Baal'; Carthage, as we have seen, is 'new town.'

The invention of letters is often ascribed to the Phœnicians. The Greeks believed that letters had come to them from Phœnicia. As the works and wanderings of the Tyrian Hercules mythically picture the progress of Phœnician colonization, so Cadmus

represents in the same way the influence and spread of Phœnician culture. Letters were said to have been brought to Greece by Cadmus—an eastern man. The so-called Cadmean letters of the Greek alphabet are A B Γ Δ Ε Ζ Η Θ Ι Κ Λ Μ Ν Ο Π Ρ Σ Τ, the sixth letter F being the Hebrew פ, or the digamma. The names of these letters have no meaning in Greek, but they have each a significance in Phœnician or Hebrew. Thus A is *aleph*, an ox, B, *beth*, a house, Γ, *gimel* or *gamal*, a camel, Δ, *daleth*, a tent-door, and T, or *tau*, a cross. The tongue in which these names are significant must be an old one, for the written sign was probably at first a rude sketch of the object, and the initial sound of its name became the power and expression of the letter. The affinity of the old Greek letters in form to the Phœnician and early Hebrew can be easily traced. The names of many of the Cadmean letters end in α, the emphatic form of an Aramaic noun—a presumption, as some suppose, in favour of an Aramaic origin, or perhaps only of an origin from the northern confines of Phœnicia.

The literature of Phœnicia has perished. A few fragments of Sanchoniathon have been preserved by Eusebius, but their genuineness is now denied by such scholars as Movers, and they are regarded as a forgery made by Philo Byblius, who professes to translate them into Greek. Mochus is referred to as the author of an atomic theory. Theodotus, Philostratus, Menander, Dios, Hieronymus are called Phœnician writers, but little more than their Greek names remain, with brief allusions or extracts in the Christian apologists. Still, if excavations were made with care in these old Phœnician towns, as have been made at Nineveh and other places, many relics of interest would no doubt be brought to light. As a specimen of what may be anticipated, Thomson (*The Land and the Book*) describes the finding at Sidon in January, 1855, of a sarcophagus, which was bought by the Duc de Luynes, and is now in the Louvre. The long inscription on the lid, in Phœnician characters, which have been deciphered, tells that the sarcophagus is that of King Ashmunazer, and it must belong to an early period, for he calls himself the possessor or conqueror 'of Dor, Joppa, and ample corn-lands at the root of Dan.' There are two kinds of Phœnician writing which can be clearly distinguished. The ancient form, which is purer, more orthographical, and very neatly inscribed, is found on the monuments of the mother country itself, and of her colonies in Malta, Carthage, Citium, and Athens; the later form, in which the language is corrupt, the letters less artistically cut, and even mixed with strange (probably degenerate) characters, is to be met with in the inscriptions found in some parts of North Africa, Cilicia, Cyprus, Sardinia, Spain, &c.

Among books on Phœnicia and the Phœnicians we may mention Gesenius, *Scripturæ Linguaeque Phœnicicæ Monumenta quotquot supersunt* (1837); Movers, *Die Phönizier* (5 vols., 1841–56), and Phœnizien, in Ersch and Gruber's *Allgemeine Encyclopädie*; Kenrick, *History and Antiquities of Phœnicia* (1855); Davis, *Carthage and her Remains* (1861); Rénan, *Mission de Phénicie* (1864–74); Perrot and Chipiez, *History of Art in Phœnicia, Cyprus, and Asia Minor* (2 vols., 1885); G. Rawlinson, *History of Phœnicia* (1889); Gutschmid, the article Phœnicia, in the *Encyclopædia Britannica*; &c.

PHENIX, a fabulous Egyptian bird, about the size of an eagle, with plumage partly red and partly golden. According to the story told to Herodotus the bird came from Arabia once every 500 years to the sanctuary particularly dedicated to it at Heliopolis, bringing with it the dead body of its parent, which it inclosed in a large egg of myrrh, and buried in the shrine. It is further related that when it felt its life

drawing to a close it built itself a nest, to which it imparted the power of generation, so that after its death a new phoenix rose out of it; while other versions speak of a worm, which, proceeding from the body of the dead bird, was developed into a new phoenix. A more modern and popular modification of the story runs that the bird, at an age of 500 years, conscious of its approaching death, built a funeral pile of wood and aromatic gums, which it lighted with the fanning of its wings, and rose from the flames with a new life. Similar stories of marvellous birds occur in the oriental mythologies, as, for instance, the myth of the Persian bird *simorg* and that of the Indian *semendar*. Ancient writers mention four periods as having been marked by the appearance of the phoenix in Egypt: under Sesostris, under Amasis (569-525 B.C.), under Ptolemy III. (247-221 B.C.), and under Tiberius (34 A.D.). In the Clementine epistle to the Corinthians it is now and again used as an illustration of the doctrine of the resurrection; it had been regarded by the Egyptians as the symbol of immortality thousands of years previously; it appears on the coins of several Roman emperors as a symbol of their own apotheosis or as the dawn of a more glorious era under their reign.

PHOLAS, a genus of Lamellibranchiate Mollusca belonging to the section Siphonida of that class. This genus forms the type of the family Pholadidae, in which the shell gapes at both ends. It is of thin white texture, and studded over on its outer surface with numerous rasp-like prominences. Accessory pieces or valves are present in the shell, which also exhibits transverse ridges and longitudinal furrows on its exterior. The umbones or beaks of the shell are covered with callosities. No hinge or ligament exists in the shell. The animal is club-shaped and thick, and possesses a short obtuse 'foot.' The breathing-tubes or 'siphons' are very long, and united to nearly their tips, which exhibit fringed edges. The mantle lobes are united or closed in front.

These molluscs form typical examples of *lithodorous* or 'stone-boring' mollusca, since they excavate burrows in rocks of various kinds, and live within these burrows, their siphons forming the media through which communication is kept up with the outer world. Various theories have been advanced to account for the mode in which the burrows are excavated. The hypothesis of a chemical solvent was long debated; whilst the action of the foot and of imbedded siliceous particles was similarly contested for. The true explanation depends upon the recognition of the shell and its rasp or file-like surfaces as the boring organ; and by means of this structure, together with the jets of water from the siphons, as tending to carry off waste particles, the hardest rock is in due time excavated. These shells are popularly known as 'piddocks,' and are eaten on many parts of the British coasts. The common species is the *Pholas Dactylus*; and the *P. candida*, *P. parva*, and *P. crispata* are also found in Britain. *P. papyracea* and *P. melanoura* are additional examples. These molluscs appear to possess the power of emitting a phosphorescent light, *P. Dactylus* being specially noted on this account.

PHONETIC WRITING. See WRITING.

PHONOGRAPH, an instrument invented in 1877 by Edison of America, by means of which articulate sounds can be registered permanently, and afterwards reproduced from such mechanical register. The instrument as originally made consists of a mouth-piece, having a stretched membrane; connected with the centre of this membrane is a steel point, which, when the sounds are projected on the membrane through the mouth-piece, vibrates backwards and forwards. This arrangement is placed before a

cylinder which rotates upon a horizontal axis. A spiral groove is cut upon the surface of this cylinder, and a similar spiral screw fitted in a nut is cut upon the axis of the cylinder; the pitch of both spirals is the same. By means of a handle attached to the axis the latter with its attached cylinder can be rotated. The cylinder has therefore a motion of rotation and translation, the latter being at right angles to the plane of rotation. The whole may be set in motion by clock-work, electricity, or otherwise, instead of by hand.

When the instrument is to be used a piece of tin-foil is laid round the cylinder, being kept close to it by means of gum or water, and the stand holding the mouth-piece is brought close to one end of the cylinder; the steel point of the diaphragm is then adjusted so as to be just touching, or close to the tin-foil, and above the line of spiral groove. It will be seen, then, that any movement of the steel point due to the motion of the diaphragm will cause a slight indentation of the tin-foil, which will by such movement be slightly depressed into the groove beneath it; and if the cylinder be rotated, that the steel point will, from the pitch of the groove and screw being alike, always be over the line of groove.

If the instrument be then set as above described, and some words be spoken into the mouth-piece, whilst at same time the cylinder is kept in rotation, a series of minute marks are made upon the tin-foil by the movements of the steel point, and these markings have all an individuality of their own due to the varying sounds addressed to the mouth-piece. So far a register only of the sounds emitted has been obtained, and we have now to show how these sounds in this manner, fixed as it were on the tin-foil, can be reproduced. To effect this the mouth-piece must be drawn back, and the cylinder rotated in the reverse direction to what it was at first, so as to bring the same part of the tin-foil with which the operation commenced back to the point at which it started, viz. opposite the steel point. The diaphragm with its steel point is then approached towards the tin-foil as at first, and is now resting upon the same point of the tin-foil as it had previously first indented. The cylinder is now rotated as at first, with the result that the small indentations or sound markings made previously now act upon the steel point by causing it to rise or fall, or otherwise move as the markings pass beneath it; the result of this is that the diaphragm in connection with the steel point is thrown into a state of vibration exactly corresponding to the movements induced by the forms of the markings, and thus affects the air around so as to produce sounds, and these vibrations being exactly similar to those originally made by the voice necessarily reproduce these sounds to the ear as the words at first spoken. The diaphragm in this way acts as the medium of transmission of sounds to be registered on the tin-foil, and as the medium of reproduction of these sounds from the metallic register on which they have been impressed. The strips of foil can be kept for any length of time before the sounds are reproduced.

In Edison's improved phonograph tubes of wax are used instead of the tin-foil, the cylinder fitting into the inside of the tube, and the markings being made on the surface of the wax by a fine steel point. When the cylinder is required to receive a fresh set of words (or sounds of any kind) a slight shaving can be taken off its surface by a special tool, leaving it quite smooth again. Phonographs are now used for various purposes, as by singers and elocutionists to enable them to get the exact effect of their own voice, and by business men in connection with their correspondence. One of the most interesting par-

poses to which it may be put is that of giving a permanent record of the voice of distinguished men, which may exist long after their death.

PHONOGRAPHY. See **SHORT-HAND**.

PHOSPHATES. See **PHOSPHORUS** and **MANURE**.

PHOSPHORESCENCE is the property which certain bodies possess of becoming luminous without undergoing combustion. Inasmuch as phosphorus exhibits this property in a marked degree the name has been hence derived. Two pieces of quartz emit light on being rubbed together. Light is seen in breaking lumps of sugar. A variety of blende (sulphide of zinc), on being scratched with a knife, emits a fine yellow light. In the year 1863 Mr. Boyle observed that the diamond, when slightly heated, rubbed, or compressed, emitted a light almost equal to that of the glow-worm. The most complete account we possess of the phosphorescence of minerals is that furnished by Sir D. Brewster. He obtained his results by placing fragments of the bodies examined upon a thick mass of iron heated a little below redness, or introducing them into a pistol-barrel similarly heated. The following table presents some of his results:—

Name of the Minerals.	Colour of the Minerals.	Colour of the Light.
Fluor-spar.	Pink	Green.
"	Purple.	Bluish.
"	Bluish white.	Blue.
"	White	White sparks.
Calcareous spar.	Transparent.	Yellowish
Apatite.	Pink	Yellow.
Aragonite.	Dirty white.	Reddish yellow.
Harmotome.	Colourless.	"
Topaz.	White and bluish	Bluish.
Rubellite.	Reddish.	Scarlet
Petalite.	Reddish white.	Bright blue.
Anatase.	Dark brown	Reddish yellow

The phosphorescence of anatase is entirely different from that of the other minerals. It appears suddenly like a flame, and is soon over. Certain varieties of fluor require no more heat than that of the hand to occasion the emission of light. The phosphoric light of minerals has the same properties as the direct light of the sun. The foregoing are instances in which it was not necessary to expose the bodies to the light previous to their exhibiting phosphorescence. Certain artificial compounds emit light in consequence of the action of extraneous light. The most powerful of these is the compound called Canton's phosphorus. It is formed by mixing three parts of calcined oyster-shells in powder with one of flowers of sulphur, and ramming the mixture into a crucible, and igniting it for half an hour. The bright parts will, on exposure to the sunbeam, or to the common daylight, or to an electrical explosion, acquire the property of shining in the dark, so as to illuminate the dial of a watch and make its figures legible. It will, indeed, after a while, cease to shine; but if we keep the powder in a well-corked vial a new exposure to the sun's light will restore the phosphorescent quality. When the electric discharge is transmitted along the surfaces of certain bodies, or a little above them, a somewhat durable phosphorescence is produced. Sulphate of baryta gives a bright green light, acetate of potash a brilliant green light, and rock-crystal a red and then white light. Temperature has a marked effect on the emission of light by these bodies. When they are shining, the luminous appearance ceases if they are exposed to the cold of a freezing-mixture. It becomes more vivid by applying heat; and if it has ceased, it may be renewed by applying a stronger heat. The following fluids have been found by Sir D. Brewster to be phosphorescent when poured into a cup of heated iron:—

Albumen (white of an egg) diluted in water, isinglass in solution, saliva, soap and water, solution of rhubarb, solution of common salt, solution of nitre, talow (the phosphorescence of which may be observed when a candle is extinguished in a dark room), alcohol, oil of dill-seeds, and oil of olives. In most of the instances of phosphorescence enumerated above there appears to be no chemical change taking place in the body which emits the light. The change is purely mechanical; by heat, by friction, or by electricity the molecules of the body are caused to vibrate so rapidly that the phenomenon of light is produced. The substances which exhibit this kind of phosphorescence are generally bad conductors of heat and of electricity. In other instances, however, phosphorescence is accompanied with a true chemical change; thus a stick of phosphorus emits a pale blue light in the dark. The phosphorus is here slowly oxidizing, with formation of the new substance phosphorus trioxide (P_2O_3).

PHOSPHORESCENCE (ANIMAL) and LUMINOUSNESS is the name applied to the scintillating or phosphorescent light emitted from the bodies of certain marine animals. This phenomenon is well seen on the surface of the ocean at night. Each movement of the vessel or of the oars, or each ripple of the waves, causes gleams of a weird light to pass over the surface of the sea, or starts sparks of light in its depths. Phosphorescence was known to and observed by the ancients, who also speculated as to its cause; and the phenomenon has not escaped the usual fate of similar strange appearances in being regarded by the ignorant and superstitious as of unreal and supernatural origin.

The animals in which the luminous property has been observed belong to every main group of the zoological series from fishes downwards. Beginning with the Protozoa or lowest sub-kingdom of animals, we find a prominent example of a luminous form in the *Noctiluca miliaris* (which see), an organism most nearly allied to the Infusorian animalcules. This organism appears to be the chief cause of the *diffused* luminosity of the sea, these animalcules existing in immense myriads in the waters of the ocean. Other and true Infusoria appear also to possess phosphorescent properties. Among Coelenterate forms many of the Medusæ (see *MEDUSÆ*) or Jelly-fishes are prominent in respect of their luminous qualities. The *Physalia*, or 'Portuguese Men-of-War'; the *Cestum Veneris* and other Ctenophoræ; many Zoophytes; the *Pennatulæ phosphorea*, or luminous 'sea-pen,' &c., all exemplify phosphorescent forms belonging to the Coelenterate group. Some Echinodermata, exemplified by certain Star-fishes, are luminous. Amongst the Annulosa many Annelides or Worms (for example, certain Errantia or marine worms); certain Myriapoda (for example, Centipedes and Millepedes); some Insects, chief among which are the Fireflies (*Elater*), the Lantern-flies (*Fulgora*), and the Glow-worms (*Lampyris*), &c.; and certain Crustacea (*Cyclops*, *Gammarus*, &c.) are luminous. Those animals known as Sea-squirts or Ascidians (Tunicata) also include luminous forms. In this class the *Salpæ*, and more particularly the compound Tunicates known as *Pyrosomæ*, are luminous. The latter name, indeed, has reference to the phosphorescent properties of the genus, which is represented by free and oceanic forms, presenting at night the appearance of moving masses of flame. Humboldt describes the beautiful appearance of the luminous *Pyrosomæ*, of which genus several species are known—*P. Atlanticum* of the equatorial seas, and *P. elegans* and *P. giganteum* of the Mediterranean, being familiar examples. Mr. Bennett describes the appearance produced by *P. Atlanticum* as 'a broad and extensive sheet of phos-

phorescence, extending from east to west as far as the eye could reach.' This was in lat. 30° s. and 27° 5' w. long. The *Pholas* (which see) or Piddock, a genus of Mollusca belonging to the Lamellibranchiate class—the members of which genus possess bivalve shells, like the oysters, mussels, &c., and bore into rocks by means of their shells—also exhibit luminous properties. The *Pholas Dactylus* is specially mentioned as a phosphorescent species, and other kinds of higher Mollusca present instances of analogous, though less marked, phenomena. Among the Vertebrate animals are included a few examples of luminous forms; the majority of instances of phosphorescence being thus seen to be included in the Invertebrate series, and chiefly amongst marine animals. Certain fishes exhibit a great amount of phosphorescence, especially deep-sea forms.

Regarding the *appearances and nature* of this animal phosphorescence a variety of information has been collected. The intensity, regularity, and colour or hue of the light vary greatly under different circumstances, such as those connected with the temperature, and other physical and surrounding conditions of the animals emitting it. The hue of the phosphorescence emitted by *Pholas Dactylus* is thus stated to be bluish white; in *Lampyrus noctiluca*, one of the glowworms, it is greenish blue; in *L. Italica* it is bright blue; whilst in one of the fireflies (*Elatér noctilucus*) the light emitted is of a brilliant green, with spots of a golden blue. The light has been found to vary in the intensity and regularity of its emission. Some Mollusca appear to be permanently phosphorescent, as also are certain fireflies; but the more general rule is that the luminousness is intermittent, and is produced under the influence of stimuli of various kinds. Thus, changes in temperature and other alterations of the medium in which the phosphorescent animals exist produce variations in the intensity of the luminousness. The warmer seas appear to be those in which luminosity is chiefly observed; hence, although phosphorescence is also observed in Arctic seas, we conclude that a high temperature is that best adapted for its favourable exhibition. The glowworms shine most brightly in temperate regions during summer, and less brightly in autumn.

Artificial irritation, as by being struck or after collision with other bodies, undoubtedly stimulates the emission of phosphorescence. Many luminous forms, which when at rest are perfectly dull and quiescent, sparkle brilliantly on being touched. Noises appear to act in an opposite manner upon luminous insects, and thus cause them to cease from shining. Movements on the part of phosphorescent animals, probably on account of their being due to muscular action and nervous activity, seem to intensify the light. The nervous influence, as we shall presently notice, is probably very intimately connected with the actual source and origin of the luminosity. And the sexual instincts, in the case of some insects at least, have been alleged to be intimately connected with the emission of phosphorescent light. Thus, in the glowworms the light emitted by the females has been regarded as being solely destined to guide the males, and is stated to grow less brilliant after the deposition of the eggs. But this theory is inapplicable to all cases in which luminousness is observed. Electricity applied in the form of galvanic currents passed through the water appeared to result in the intensification of the luminosity; but removal from their native sea-water to fresh water, or to other media, had the effect of soon extinguishing the phosphorescence in marine forms. Similarly, in the case of glowworms, removal from the atmosphere to a vacuum caused the phosphorescence to cease.

With regard, in the last instance, to the parts or organs in various animals which produce this luminosity, and also concerning the mode in which such organs produce the phosphorescence, little will require to be said. In some cases the source of the light appears to be distinctly localized within the bodies of the animals producing it. Thus, in some Medusæ so-called *luminous points* have been observed. In *Berée*, one of the higher Coelenterata, Ehrenberg says the luminosity issues from the ovaries, and in a nearly allied form from the cirri or tentacle-like filaments with which it is provided. The light of *Pholas* is emitted apparently from the inside of the *siphons* or breathing-tubes. (See PHOLAS.) In other forms the luminosity appears to be more diffused, and to exist generally throughout the tissues of the organism. Whilst in many marine animals a *luminous mucus* or viscid secretion, given off from their bodies, and mixing with the water, is regarded as the source of the phosphorescence. In insects the seat of the luminosity can be more accurately determined. Thus, in the female glowworm the light proceeds from the hinder abdominal segments; the fireflies are luminous in their chests, and also from their abdomens; whilst in *Scolopendra electrica*, a centipede-form, the light proceeds from the head. The intimate structure of luminous organs in insects appears to exhibit a simple conformation, and a fatty composition. Treviranus, indeed, concluded that the adipose or fat-tissue of insects was the general seat of this luminousness.

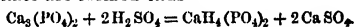
Various theories have from time to time been enunciated with regard to the mode in or through which the luminous organs in animals, whatever their nature, operate to produce the phosphorescence. By Mayer, &c., the light of the sun absorbed and re-emitted from the animal organization was held to be the source of the luminousness. Light swallowed (!) with the food, and elaborated by special organs, was the chief element in Brugnatelli's theory. Spallanzani maintained a chemical hypothesis, that the oxygen of the air formed the chief element in a supposed combustion productive of luminousness. Macaire's ideas resolved themselves into the theory that the essential luminous matter consisted of phosphorus and albumen, and that upon the more or less perfect coagulation of the latter depended the intensity or decrease of the luminosity. Darwin, Treviranus, Davy, &c., in part adopted Spallanzani's view of the combustion of oxygen; but they held that this element introduced in breathing acted upon phosphorus secreted by the luminous organs, and so produced the luminosity. Whilst a last hypothesis, supported by Todd and Macartney, held that the luminosity was solely a *vital* effect dependent upon a peculiar exhibition and modification of the *nervous system*; and that just as in ordinary cases *nerve-force* may be transformed into *motion* or into *electricity*, so in this special case it is transformed into *light*. Tiedemann's view included the phosphorus and oxygen theory of Darwin, &c.; but the former physiologist also held that the secretion of the phosphorescent elements was in itself a vital act.

Without entering into the merits of these various suggestions, it may be simply stated that the views of Todd and Macartney, which maintain the sole action of the nervous system and vital or nerve force in the production of the luminosity, are those which most satisfactorily and thoroughly meet and tally with the researches and opinions of modern physiology and zoology. And the luminosity of animals may therefore be most safely regarded as a peculiar modification of nerve-force, exerted in some instances through specialized structures (as in insects), or in other cases through the general tissues or secretions.

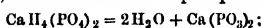
The absence of a distinct nervous system in such low forms, as Noctiluca, Medusa, &c., does not in the least militate against this theory. Since physiologists are now reconciled to the belief that nervous acts and the phenomena of correlation may be exhibited without the presence of, and entirely dissociated from demonstrable nerve-tissues. In cases where luminosity is exhibited after death, this result is simply due to the *somatic vitality* (or that of the *tissues*), being for a certain period inherent in the lifeless body. This theory, moreover, does not entirely lay aside some of the other theories or ideas already mentioned. No one may deny that every vital act, although essentially taking origin from a vital force, may yet avail itself of and be manifested through chemical or chemico-physical laws and conditions. And even if, in certain cases, actual chemical actions may be proved to occur, this discovery would not lessen the value or application of the theory; since these actions can only be exerted as part of a living organization, which is controlled by vital force and subject to vital laws.

PHOSPHORITE, a massive raditated mineral, consisting essentially of phosphate of calcium, obtained chiefly from Estremadura in Spain.

PHOSPHORUS was discovered by Brandt in 1669, though there are some reasons for believing that the alchemists of an earlier period were also acquainted with this substance. Brandt kept his process secret for some time. Kunckel, another German chemist, knowing only that Brandt had procured it from urine, entered on the investigation, and succeeded in discovering the process. Mr. Boyle, in England, also discovered it, and Godfrey Hankwitz, a man who was taught the process by Boyle, sold it for many years at a high price in London. In 1769 Ghan discovered that phosphate of lime is the basis of bones; and six years later Scheele published a process for extracting phosphorus from bones, a modification of which process is still in general use. Bone-ash contains a large amount of tricalcic phosphate, $\text{Ca}_3(\text{PO}_4)_2$. When ground bone-ash is acted on by sulphuric acid, calcium sulphate and mono-calcium phosphate are formed thus—



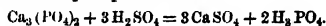
The solution of mono-calcium phosphate is next evaporated to a syrupy consistency, and charcoal or coke is mixed with it. This mixture is heated in earthenware retorts placed in a furnace, at first moderately, when calcium metaphosphate forms—



and afterwards more strongly, when the following reaction takes place:—

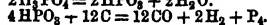


The phosphorus not obtained free by this process may be isolated by adding silica. The process of distillation extends over several days, and the phosphorus, after being condensed, is collected under water as a viscous liquid. A new process of comparatively recent introduction has largely displaced that above described, and mineral phosphates, owing to their greater cheapness, are being widely used in place of bone-ash. The phosphates are treated with excess of sulphuric acid so as to form calcium sulphate and free phosphoric acid—



The acid is filtered off through a bed of ashes supported on a grating in a wooden tank lined with lead, and after being concentrated by heating by means of steam coils, it is led into cooling tanks to allow the remainder of the sulphate to separate out. The acid is then mixed with sawdust, charcoal, or coke, and dried in an iron pot, and the whole is then

put into earthenware retorts, of which several are placed in one furnace. From each retort a pipe leads to a trough of water, and dips below the surface. After about sixteen hours' distillation all the phosphorus will have collected under the water in the troughs. The equations for the distillation are—



Better in several respects is the still more recent process introduced by Readman, Parker, and Robinson, for which see Thorpe's Dictionary, vol. iii.

The phosphorus, as obtained in the receivers, must undergo purification; it is generally mixed with carbon, silicon, and various other impurities. Pure phosphorus is obtained either by mechanical or by chemical treatment of the crude material. The former method consists in squeezing the substance through canvas bags or through porous earthenware, the latter in oxidizing the impurities (and removing them as a slag) by means of sulphuric acid and potassium bichromate. The latter or chemical method is more generally adopted. Phosphorus generally comes into the market in sticks; these are formed by running the molten substance into glass tubes surrounded by cold water, where it quickly solidifies.

Phosphorus, when pure, is an almost colourless, wax-like, transparent solid, which melts at 44°C , boils about 290°C , and has a specific gravity of about 1.8. When cooled to a low temperature phosphorus becomes hard and brittle; when broken, it exhibits a crystalline fracture; indeed it may be obtained in well-defined octahedral crystals by evaporating its solution in carbon disulphide. After phosphorus has been prepared for some time it loses its transparency, becomes white and opaque, and less dense than before. Black phosphorus is also produced under certain conditions; but the red or amorphous variety of phosphorus is the most remarkable. If ordinary phosphorus be heated to near its boiling-point in an atmosphere which is incapable of chemically acting upon it, a change is gradually brought about in the structure of the substance, the wax-like, crystalline solid being gradually transformed into a red, amorphous powder.

Ordinary phosphorus is very readily oxidized, taking fire spontaneously when exposed to air; amorphous phosphorus does not ignite until heated to 260°C ; ordinary phosphorus is soluble in carbon disulphide, amorphous phosphorus is insoluble in this reagent; ordinary phosphorus has a specific gravity of about 1.8, the specific gravity of amorphous phosphorus is about 2.2; ordinary phosphorus is extremely poisonous, amorphous phosphorus is not poisonous; notwithstanding these well-marked differences in physical characters, and even in toxicological action ordinary and amorphous phosphorus are to the chemist one and the same elementary substance.

Phosphorus very readily combines with oxygen. If a stick of the dry substance be allowed to remain in contact with air it speedily takes fire and burns, with the production of phosphoric pentoxide, P_2O_5 . If this experiment be carried on in the dark a peculiar greenish light will be noticed playing around the stick of phosphorus for some time before it bursts into flame; this light (see PHOSPHORESCENCE) is produced by the slow oxidation of the phosphorus, with the production of the trioxide, P_2O_3 . On account of its easy inflammability phosphorus must be kept out of contact with air; it must not be touched for any length of time with the fingers, and it must not be brought into a heated atmosphere. The greatest care is necessary on the part of any one in working with this substance.

In its chemical relationships phosphorus is allied

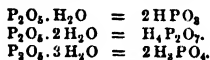
to nitrogen arsenic, antimony, and bismuth; it has the power of combining with three atoms of hydrogen or other monovalent element, it is therefore a triad. The atomic weight of phosphorus is 31; its vapour is sixty-two times heavier than hydrogen, not thirty-one times, as would have been the case did it obey the general rule concerning the vapour densities of the gaseous elements.

Phosphorus is used largely in the arts, especially in the manufacture of lucifer matches, which are tipped with a paste containing phosphorus and another material which readily parts with its oxygen, such as chlorate of potassium, peroxide of lead, &c. Safety-matches—that is, matches which ignite only when rubbed on a prepared surface—generally contain chlorate of potassium and sulphide of antimony made into a paste with gum, while the prepared surface contains amorphous phosphorus.

The annual production of phosphorus in Europe amounts to about 5500 cwts, involving the consumption of 66,000 cwts. of bones.

As has been already mentioned, two oxides of phosphorus may be produced by oxidizing the element in air. The first of these, *phosphorus trioxide* (P_2O_3), is best produced by burning phosphorus in a very slow current of dry air; it forms a bulky, white, amorphous sublimate, which greedily takes up water, forming *phosphorous acid*, thus, $P_2O_3 + 3H_2O = 2H_3PO_3$. This acid, which is also produced in many other ways, forms transparent, colourless crystals, which are deliquescent in the air, melt at $74^\circ C.$, and dissolve in water to form a strongly acid liquid, which oxidizes to phosphoric acid on exposure to the air. Phosphorous acid is dibasic, two of its hydrogen atoms only being replaceable by metals. The general formulae for the phosphites are therefore $MH_2P_2O_3$ and $M_2H_2P_2O_3$, where M represents a monovalent metal. Each or all of the three hydrogen atoms may be replaced by alcoholic radicles, giving rise to a series of ethers, the general formulae for which are $XH_2P_2O_3$, $X_2H_2P_2O_3$, and $X_3P_2O_3$, where X represents a monovalent radicle, as ethyl, methyl, &c. A large number of phosphites is known.

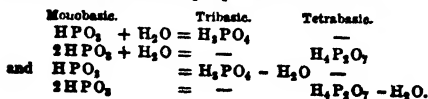
Phosphorus pentoxide (P_2O_5) is produced as a snow-white, amorphous substance, by burning phosphorus in excess of perfectly dry air or oxygen. This substance combines very energetically with water, with a hissing noise. Three different acids are produced by this reaction, which may be written thus—



To all of these acids the generic name of *phosphoric acid* is applied; but certain prefixes are used to distinguish them from each other:—

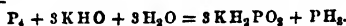
HPO_3	<i>monobasic or meta-phosphoric acid.</i>
$H_2P_2O_4$	<i>tribasic or ortho-phosphoric acid.</i>
$H_4P_2O_7$	<i>tetrabasic or pyro-phosphoric acid.</i>

The monobasic acid is produced by the action of cold water on the pentoxide; the tribasic acid is produced by the action of hot water on the same body; the tetrabasic is produced by the very gradual absorption of water by the monobasic acid. Or, starting with the most hydrated acid, namely, the tribasic, we may produce the tetrabasic by driving off part of the water, and the monobasic by driving off a further quantity of water. These reactions are made evident by the following equation:—



Three classes of phosphates are therefore known, the *meta-phosphates*, represented by the formula MPO_3 ; the *ortho-phosphates*, represented by the formulae MH_2PO_4 , $M_2H_2P_2O_4$, and $M_4P_2O_7$; and the *pyro-phosphates*, represented generally by the formulae $MH_2P_2O_7$, $M_2H_2P_2O_7$, $M_4H_2P_2O_7$, and $M_4P_2O_7$. Another acid of phosphorus, namely, *hypo-phosphorous*, H_3PO_2 , is known; it is a monobasic acid, forming salts MH_2PO_2 .

Phosphoretted hydrogen, or *phosphine* (PH_3), is a gaseous substance, which is produced by heating phosphorus with the solution of a caustic alkali, thus—



The gas inflames spontaneously on coming into contact with air, being hereby burned; thus $2PH_3 + O_2 = P_2O_3 + 3H_2O$. If, however, the gas be passed through a tube surrounded by a freezing-mixture, a small quantity of it is condensed to a liquid, and the remainder no longer takes fire on issuing into the air. The liquid in the cold tube is another hydride of phosphorus, and it is to the presence of a small quantity of this liquid in the gaseous hydride that we are to trace the spontaneous inflammability of the mixture.

A great many other compounds of phosphorus are known; thus we have two chlorides, PCl_3 and PCl_5 ; two or perhaps three iodides, bromides, sulphides, &c. Those which we have already described are the most generally interesting compounds of this element.

PHOSPHORUS BASES. This name is applied to a large series of bodies which contain phosphorus united with an organic radicle. The two principal members of the series, from which the others are derived, are *trimethyl phosphine* $(CH_3)_3P$, and *triethyl phosphine* $(C_2H_5)_3P$. These substances may be looked on as phosphoretted hydrogen (PH_3), in which the hydrogen is replaced by the radicles methyl and ethyl respectively.

PHOTIUS, a patriarch of Constantinople in the ninth century, born of patrician parents in that city about the year 815. His wealth and interest raised him to the highest offices of the state, whilst he enjoyed the reputation of being the most universally learned and accomplished man of his age. When he held the nominal office of captain of the guards he was sent on a diplomatic mission to Assyria (or more probably Persia), and he employed the leisure which his light duties afforded him in composing his *Myriobiblion*, his chief literary work. He afterwards became secretary of state under the emperor Michael III., and contracted an intimacy with the minister Bardas, uncle of the emperor. The patriarch Ignatius having drawn upon himself by his plain speaking the displeasure of the weak and profligate Michael, it was resolved to deprive him of his sacred office. An attempt was made to induce him to resign, but it failed, and the unfortunate patriarch was deposed with great indignity, imprisoned, and afterwards sent into exile. Bardas now persuaded the emperor to raise Photius to the patriarchal dignity. He was, it is true, a layman; but in the space of six days he hurried through all the stages of sacred orders, and on Christmas-day, 858, was consecrated patriarch by Gregory, bishop of Syracuse, lately deposed by the Roman pontiff. The installation was recognized by the metropolitans of the patriarchate, but was opposed by Pope Nicholas I., whom Photius soon after excommunicated. But the Emperor Michael having been murdered in 867 by Basil, who was raised to the throne, that prince immediately replaced Ignatius in his office, and banished Photius, who, however, resumed his dignity on the death of Ignatius in 878. On the accession of Leo, son of Basil, to the imperial throne in 886, Photius was again deposed, and ban-

ished to a monastery in Armenia, where he died in 891. His death might have put an end to the division he had occasioned between the Greek and Latin Churches, had not the popes refused to acknowledge the priests and bishops ordained by him, and insisted upon their degradation. This unseasonable assertion of authority so exasperated the Greeks that, although all intercourse between the churches was not broken off, the schism which has ever since subsisted had taken root. It is now impossible to arrive at a correct estimate of the character of Photius; his biographers belonging to the Roman Church ascribe to him every excess of craft, violence, and perfidy; while those of the Greek Church as unstintedly eulogize him. He was an able man of the world, but not influenced by the high principles which befitted his sacred office; yet he was probably not below the average of the statesmen and prelates of that corrupt age. His chief remains are: (1.) the *Myriobiblion* above mentioned, which may be described as an extensive review of ancient Greek literature by a scholar of immense erudition and sound judgment. The number of books reviewed amounts to 280, and as many which are no longer extant are epitomized, it is scarcely possible to over-estimate the value of Photius' work. The best edition is that of Bekker (Berlin, 1825). (2.) *Nomocanon*, a collection of the canons of the councils, imperial laws concerning ecclesiastical matters, &c. (3.) A Greek Lexicon, of which editions have appeared at London (1822) and Leyden (1864-66). (4.) A collection of letters, many of them extremely interesting and elegant (Greek and Latin, London, 1651). (5.) A treatise on the Holy Spirit, in which he maintains that the Spirit proceeds from the Father only. A collective edition of Photius' works has been published in Migne's *Patrologia Græca*; but many of his writings are still in manuscript. See Hergenröther, *Photius, Patriarch von Konstantinopel* (Ratisbon, 1867-73).

PHOTOGRAPHY (Greek, *phōs*, *phōtos*, light; and *graphō*, I write) is the science of making representations of objects on sensitive films by the action of light passing through a lens. In the year 1556 the alchemist Fabricius observed that the colourless silver ore called 'horn silver' (silver chloride) was darkened to a violet colour by the action of light, and thirteen years later Giambattista della Porta of Padua invented the camera obscura. These two discoveries were the small beginnings from which modern photography has grown; here were the progenitors of the dry plate and the camera of to-day. Over two hundred years elapsed before the discovery by Fabricius was further investigated, when in 1777 the eminent Swedish chemist Scheele made a careful scientific investigation of the action of light on chloride of silver; the most important of his observations being that the rays from the violet end of the spectrum most quickly darkened the chloride of silver, and that the action of light decomposed it, causing the formation of metallic silver and the liberation of chlorine. Senerbier confirmed Scheele's work; and further advances in the study of the action of light on silver salts were made by Ritter of Jena (who discovered the chemical action of the invisible ultra-violet rays of the spectrum), by Seebeck, and by Wollaston; while Davy, Desmoriens, and Bäckman experimented with the action of different spectrum rays on other substances.

The credit of being the first to publish an account of a complete photographic process undoubtedly belongs to Thomas Wedgwood, whose researches were posthumously tabulated by Sir Humphry Davy, and published in the *Journal of the Royal Institution*, in June, 1802, under the title of 'An Account of a Method of Copying Paintings upon Glass and of

making Profiles by the Agency of Light upon Nitrate of Silver, with Observations by H. Davy'. Wedgwood used white paper or white leather moistened with a solution of silver nitrate, which, being placed beneath the painting on glass to be copied, and exposed to the sun's rays, was darkened in inverse proportion to the density or opacity of the painting, producing black on the paper or leather under the clearer parts of the painting, and gray and brown shades under the denser parts. The experiments described in this paper were not limited to the action of silver nitrate, but mention is made that the chloride was even more sensitive than the nitrate, and 'both were more readily acted upon when moist than when dry'. The pictures produced by Wedgwood's process were fugitive, for though sodium hyposulphite had been discovered three years previously, it was left to others to apply it to the prints and to render them permanent by 'fixing'.

The next step in the progress of photography was a long stride, when for the first time a camera was used in combination with a sensitive plate, giving an image which was permanent; this important advance is due to Joseph Nicéphore de Niepce, a native of Chalons-sur-Saône, who, after holding a commission in the French army and a magisterial appointment, found his great life-work in scientific research. Coating a polished metal plate with a solution of bitumen of Judea dissolved in oil of lavender, he placed it, after drying, in a camera obscura, and after exposing it for from seven to eight hours, which he found sufficient for a landscape, he developed the latent image in the bitumen film by placing the plate in a dish containing ten parts of petroleum and one of oil of lavender. The action of the developer was to dissolve the parts unaffected by light, leaving a kind of 'negative' picture in bitumen on the plate.

Another application of his process worked by Niepce was the engraving or etching of the metal plate carrying the bitumen picture, by placing it in an acid or mordant which ate down into the metal in the parts unprotected by the bitumen, and so produced a plate which was capable of yielding impressions on paper in printing-ink, in a similar way to that used for printing line engravings, etchings, or mezzotints. Though Niepce began his researches in 1814, he did not meet with much success until 1827, in which year he communicated a paper on his process, together with specimens, to the secretary of the Royal Society, but owing to the stipulation of secrecy it was never published.

In 1829 Niepce disclosed his process, which he termed 'Héliographie', to a French scene-painter—Louis J. M. Daguerre, and a partnership was entered into between them. Too much credit has been given to Daguerre for the process called after his name, and it is but just to the memory of his collaborateur to observe that Niepce himself, prior to his partnership, made use of two of the most important features of the process which was afterwards known as 'Daguerreotype', namely, the polished silver plate, and iodine vapour. Niepce made his photograph in bitumen on the silver plate as above described, and blackened the portions of the plate where bare silver was left exposed, which corresponded to the deeper shades of the original, by exposing the plate to the fumes of iodine. Niepce and Daguerre had been in correspondence for nearly four years before they entered into partnership, and it is a significant fact that whilst Niepce sent specimens of his processes to Daguerre, the latter declined to show any specimens of his alleged results to Niepce, or describe his process, merely stating that he had made great improvements in the camera.

Little is known of the joint researches of these two men, which terminated in 1833 at the death of Niepce; but it is to be surmised that they could not long have practised Niepce's process with silver iodide, without one of them observing its sensitiveness to light; and Dr. Bauer, the secretary of the Royal Society, to whom Niepce had communicated his process, knew that, when in 1839 Daguerre posed before the world as the discoverer of the Daguerreotype process, he did a mean and unjust thing in claiming for his own the process so largely due to his dead partner, Nicéphore de Niepce.

A month before the announcement of the Daguerreotype process, viz. in January, 1839, was published in a paper read before the Royal Society, 'Photogenic Drawing', the first of the photographic processes invented by Henry Fox Talbot—to whom we owe many important advances in the art. This 'photogenic' process, invented in 1834, was substantially the same as Wedgwood's, though more rapid, and consisted in making prints of leaves, ferns, &c., pressed in contact with paper which had been prepared by soaking in weak salt and water, sensitized by brushing over it a 12-per-cent solution of silver nitrate in water, and then dried, when the same operations of salting and silvering were repeated. Fox Talbot's next process, 'Calotype', was patented in 1841.

Numerous modifications of the calotype were subsequently introduced, besides various new photographic processes, including those of M. Niepce de St. Victor, M. Le Gray, and Mr. Scott Archer, the first of whom introduced the use of albumen, Le Gray suggesting the use of collodion as a substitute for paper, and the last putting the suggestion to practical use, these substances being in each case spread over a plate of glass. All these processes have, however, been displaced by the gelatino-bromide of silver emulsion, which was introduced by Dr. R. L. Muddox in 1871; but which did not come into general use until after 1877, when Dr. J. Wilson Swan, F.R.S., the famous electrician, discovered the means of making the emulsion rapid.

It would be impossible to give here a detailed account of the different photographic processes, which are both numerous and continually receiving modifications and improvements. We shall, therefore, only present the reader with a description of four of the principal and best-known styles—the daguerreotype, the calotype or talbotype, the collodion, and the gelatine or modern dry-plate process.

In daguerreotype pictures a plate of copper, coated with silver and highly polished, is rendered sensitive to light by being placed in a box, the bottom of which is strewn with iodine. When a fine orange colour is obtained on the plate it is then, to accelerate still further the action of light, exposed to the vapour of bromine till it attains a rose colour, a thin film of iodo-bromide of silver being thus produced. This important improvement is due to Mr. Goddard, who published an account of the accelerating action of bromine in 1840. Daguerre claimed it as his invention in 1844. It is then placed in the camera for a period varying according to circumstances from a second to a few minutes, and having thus received an impression of the object desired to be represented, is removed to a box, where the picture is developed by placing the plate a few inches above a small pan of mercury. A spirit-lamp is placed beneath, and by the application of heat the mercury rises in vapour, which combines with those parts of the film which have been exposed to the light, forming thereby an amalgam with the silver. As the thickness of this amalgam varies with the intensity and duration of the action of light, different

shades corresponding to the lights and shadows of the object become apparent in the picture. The process of development is watched by the light of a candle through a pane of yellow glass in the side of the box, and when completed the picture is fixed by immersing it in a solution of hyposulphite of sodium, and then washing it with water, whereby the undecomposed iodo-bromide of silver is removed.

M. Fizeau devised the last part of the process for toning or gilding the image, which consists in pouring over the plate a solution of chloride of gold and hyposulphite of sodium, and the plate is held over a spirit-lamp till the gold produced by the reduction of its salt is burned in, after which it is washed and dried, and the picture is finished.

In sharpness and delicacy of detail the daguerreotype excels all other photographic pictures, but is very troublesome to complete successfully, and is, besides, liable to fade soon, from the tendency of mercury and silver to combine with oxygen. Another defect of the daguerreotype is that, being upon an opaque metal plate, it cannot yield copies by simple superposition, which photographs upon glass or paper are capable of doing; but daguerreotypes toned with gold by Fizeau's method have been very successfully reproduced in electrotype by Grove and others.

In the calotype or talbotype process a sheet of writing paper is washed on one side with a solution of nitrate of silver applied by a soft camel-hair brush, and when dry immersed in a solution of iodide of potassium, then dipped in water, and finally dried. The paper should now be kept excluded from the light till required for use. To make it sensitive to the action of light it is washed with a mixture of two chemical solutions, one of nitrate of silver with the addition of acetic acid, the other of crystallized gallic acid. This mixture, called *gallo-nitrate of silver*, is spread with a brush on the nitrated side of the iodized paper, which, after having absorbed the solution, is dipped in distilled water and then dried, first with blotting-paper and afterwards by heat. It is now ready for receiving the impression of the object in the camera, after which it is taken to a dark room, where the picture is developed by brushing it over with the gallo-nitrate of silver. It is then dipped in water, partly dried by blotting-paper, and fixed by washing it with a solution of hyposulphite of sodium, which dissolves the whole of the iodide of silver unacted upon by the light. The picture thus obtained is a *negative*, that is, with the lights dark and the shadows white, contrary to the natural appearance of the object. To produce a *positive* picture, where the lights and shadows shall appear as in nature, the negative is placed on the sensitive surface of another sheet of prepared paper, and a piece of glass pressed on both to ensure contact. The sunlight penetrates the negative, and darkens the parts of the underlying paper opposite the lights of the picture, whilst the parts opposite the shadows, or opaque parts of the latter, are protected. This process for obtaining a positive picture from a negative is called *photographic printing*. The printing process used by most professional photographers until the last few years consisted in the use of paper whose surface is made glossy by being coated with egg albumen. Its sensitiveness to light is due to the fact that the albumen is impregnated with nitrate of silver. By exposing this 'sensitized' paper beneath a negative a positive print is obtained, which is then 'toned' by immersion in an alkaline solution of chloride of gold, 'fixed' in a solution of hyposulphite of sodium, and finally well washed in water. The 'platinotype' process, invented by Mr W. Willis in 1874, has now come into well-deserved

popularity. The paper is prepared by coating it with a solution of ferric oxalate and a platinous salt. After exposure under a negative it is developed by floating on a hot solution of neutral potassium oxalate, when the picture appears in rich platinum black. It is fixed in weak acid and washed in water.

Another printing paper largely used at the present time is 'bromide' paper, invented by Dr. Swan. It is gelatino-bromide of silver emulsion coated on paper, and is developed and fixed in a similar manner to dry-plates.

The use of collodion in photography was first suggested by M. Le Gray, and introduced by Mr. Archer in 1850. Collodion is a fluid made by dissolving gun-cotton in a mixture of sulphuric ether and alcohol; and when used for photographic purposes is mixed with a solution of iodide of potassium or iodide of ammonium in alcohol. Glass is the substance on which pictures are taken by the collodion process. The plate being first scrupulously cleaned from stains and grease, the collodion is poured over it so as to flow over the whole surface; the superfluous fluid is then drained off so as to leave a solid film, and the plate is excited or made sensitive by the formation upon it of a small quantity of iodide of silver, brought about by immersing it in a bath composed of nitrate of silver, iodide of potassium, alcohol, and distilled water in certain proportions. After remaining there from two to four minutes it is removed, and while still in a wet state placed in the camera, where it remains for a number of seconds, varying according to circumstances. The picture is now developed by pouring over it a solution composed of pyrogallie acid, distilled water, glacial acetic acid, and alcohol, with the addition of a few drops of a solution of nitrate of silver; this solution absorbs oxygen, and so, in the presence of silver nitrate, tends to reduce the iodide of silver to the metallic state. The solution is then poured off, and the surface of the plate washed with water. To fix the picture, a solution of hyposulphite of sodium or cyanide of potassium is poured over it, and afterwards washed away by pouring water copiously over the plate, which is lastly varnished by spirit varnish, or by a solution of amber in chloroform. A negative picture is thus produced, from which a positive may be obtained in the same manner as that described above in the calotype process. Positive pictures may, however, be obtained on glass directly, without the necessity of printing, by pouring over the plate, when taken from the camera, a solution of protosulphate or protonitrate of iron and nitric acid. After a negative picture has thus been developed, a mixture of pyrogallie acid and hyposulphite of sodium is poured over it and the plate slightly warmed, when the dark parts will become of a bright white by the formation of metallic silver, brought about by the reducing action of the iron salt and nitric acid. The whitening of the image may also be obtained by the use of mercuric chloride. The picture is then placed in a frame, with a backing of black cloth or velvet to produce the shadows. Photographers frequently cover the back of the glass plate with a black varnish, instead of using the inner back of the case; but the effect is to reverse the position of the objects in the picture, making the right side appear left, and the left side right. This may be obviated by applying the black varnish to the *face* instead of the *back* of the picture, which is then viewed through the reverse side. Such positive photographs with collodion were known in the United States as *ambrotypes*; they were chiefly in vogue from 1858 to 1870 or thereabouts, and the same process applied to japanned iron plates is still used by itinerant photographers, and known as the *Ferrotypes* process.

Photography has recently made rapid advances owing to the introduction of gelatine dry-plates and films coated with an emulsion containing bromide of silver. An emulsion of bromide of silver in *collodion* was introduced by Messrs. Sayce and Bolton in 1864, and glass plates coated with such an emulsion were used *dry*, but they were slow; and it was not till gelatine was substituted for collodion that dry-plates became a commercial success. The gelatine dry-plates, of which such immense numbers are now used annually, are prepared by coating glass (or a thin transparent film known as celluloid) with an emulsion containing bromide of silver in gelatine. This emulsion is made by causing silver nitrate to combine with potassium bromide (thus forming silver bromide) in the presence of gelatine and water. This is boiled (to give increased sensitiveness), mixed with more gelatine, washed (to remove the potassium bromide), filtered, and then poured upon the plates or films and allowed to cool and dry.

The action of light on the haloid salts of silver is a subject which has not yet been fully investigated. From the most recent researches it would appear that a subsalt is first of all produced by the action of the solar rays upon chloride or bromide of silver, and that after a time the salt is further reduced, with the formation, probably, of metallic silver. The rays of the spectrum have not all the same photochemical power; in most cases the violet and ultra-violet rays bring about chemical decomposition far more energetically than the red or yellow rays. Upon different substances the same ray has not, however, the same photo-chemical effect: the maximum photographic action being, as a general rule, obtained by exposure to those rays which the particular substance under examination has the power of absorbing. The admixture of certain chemically-inactive substances, which have the power of absorbing rays not absorbed by the substance itself, may altogether alter the position of maximum effect; thus, if eosine—a reddish colouring matter—be added to silver bromide, the mixture is energetically acted upon by the indigo rays, as is also the case with the pure bromide, and also by the yellow rays which have little or no action on the bromide alone. Plates which have been treated with eosine (or some similar dye) are known as isochromatic, orthochromatic, or 'colour-sensitive' plates. They are of especial use in copying paintings, &c. The use of dyes for this purpose was first proved with collodion plates by Dr. Vogel of Berlin in 1873, and the method was applied to gelatine plates by M. Taillier of Paris in 1882.

To transfer the picture obtained in the camera to a suitable printing surface, so that faithful impressions may be produced with rapidity, and, above all, at a moderate cost, is a problem which has for many years occupied the attention of photographers. In 1839 Mr. Mungo Ponton discovered that paper impregnated with a solution of bichromate of potash became highly sensitive to light, and that by exposing it under a negative in the usual way a picture could be obtained, which was revealed and fixed by simply washing away the soluble bichromate unacted upon under the dark or opaque portions of the negative, the portions acted upon by light through the transparent parts being rendered insoluble thereby. In 1855 M. Poitevin patented a process for obtaining direct carbon prints. He combined carbon or any other pigment, in a fine state of division, with gelatine, starch, or gum, applied it over the surface of his paper, dried it, submitted it to the action of light under a photographic negative, and washed it in water. The results were only satisfactory whenever the negative was that of a subject in line or stipple; but when the negative was one

taken from a natural object the process was unequal to the task of reproducing the beautiful gradation and half-tone which we see in a good photograph. In 1856 the Duc de Luynes founded a prize of 8000 francs, to be given to the artist who should discover a process by which pictures could be produced containing all the gradation of light and shade found in a good photograph, combined with the permanence of a printed book. He also gave 2000 francs to be divided among those who, up to a certain time, had approached nearest to the desired end: and out of this fund a medal of 400 francs was given to Mr. Pouncey, of Dorchester, for his carbon process. In the early methods of carbon-printing, however, the *half-tones* were wanting. Laborde, Fargier, and Poitevin in France, and Burnett in England (between 1858 and 1860), showed that the remedy for this was to wash the *back* or *unexposed* side of the film. In 1864 carbon-printing was brought to a high state of perfection by Dr. J. Wilson Swan, to whom is due the honour of having discovered the first practical method for the production of permanent photographs in pigment, known as 'Swan's Carbon Process'. He first prepared a tissue by forming a layer of gelatine and sugar mixed with a due proportion of pigment, and which he called the tissue compound, upon paper. This compound may be mixed at once with the bichromate or sensitizer, and applied with it to the paper, in which case sensitized tissue is at once formed, which has only to be dried to be ready for use. The tissue is exposed to light under the negative with its sensitive surface in contact with the glass. After exposing for a short time, the surface of the tissue is cemented to a piece of paper, which is called the support, the picture formed on the surface of the sensitive tissue being thereby transferred to, and supported by, the second sheet of paper. This may either be permanent or temporary; if the latter, the best cement is a solution of caoutchouc in benzol. The picture, with the surplus tissue unacted upon by light, is now inclosed between the layers of paper, one only of which is permeable to water. On immersing the whole in this fluid, slightly heated, the soluble part of the compound softens and partially dissolves, and the doubled sheet splits into two portions, one taking with it the soluble tissue compound, while the other retains the insoluble portion which constitutes the picture formed by light, and which is rendered perfect by simply washing in warm water. It is, however, reversed, and must be transferred to another sheet of paper, which then becomes the final support. Gelatine, rendered insoluble by chrome alum, is usually employed as the cement in this case; and when the picture has been thus treated, it is again put between two sheets of paper. The temporary support is easily removed by spreading on its back a little benzol, and the picture is then ready to be trimmed and mounted. Swan's carbon process was modified by J. R. Johnson (1869); and by the 'flexible support', patented by J. R. Sawyer in 1874. Under the name of 'autotype' the carbon process is now largely used.

In the *Photographic News* of 14th October, 1864, was published an account of a new system of printing invented six months previously by Dr. Swan, which he called *Photo-Mezzotint*, briefly described as follows: it consisted in obtaining an image in which the shadows are in relief and the whites depressed, by exposing bichromated gelatine under a suitable negative to the action of light, and afterwards to water. From the gelatine an electrotype is obtained, with the lights in relief and the shadows depressed, as in an engraved copper-plate. This intaglio is now filled with a thick solution of gela-

tine, containing indian ink or other colouring-matter mixed with it; when slightly set, and the surface cleaned as in copper-plate printing, it is placed in contact with paper prepared to prevent it being absorbent; the cliché is then brought into firm contact by steady heavy pressure. The set gelatine and colour are thus delivered on to the paper, much in the same way that the cook delivers a shape of jelly from its mould. The resulting picture in all respects resembles a carbon print. The deepest shadows consist of a thick opaque layer forming blacks, each gradation from these to white consisting of a thinner layer of the translucent material.

About the same time, Mr. Walter Woodbury took out a provisional patent for a very similar process to that described above—but for the production of transparencies on porcelain, glass, &c., and basso-relievos in plaster, metal, &c., no mention being made of printing on paper. However, in his complete specification, published subsequently to the publication of Swan's photo-mezzotint process, Mr. Woodbury attempted to incorporate in it the idea of printing pictures on paper.

There is no doubt that the process afterwards called 'Woodbury-type' was substantially the same as Swan's 'photo-mezzotint', and though Mr. Woodbury cannot be credited with the invention of the process to which he gave his name, he introduced several important improvements in the details of the process and made it a commercial success.

Mr. Woodbury's first modification of 'Woodbury-type' was in the substitution of a mould of soft metal, obtained by squeezing the gelatine relief in contact with it by hydraulic pressure, for the electrotype mould; and in 1880 he described a simpler method called 'Stannotype', in which he took a mould in gelatine from a positive on glass—the mould was chemically hardened and coated with a thin india-rubber varnish, a piece of tin-foil was laid over it, and the whole passed through a pair of india-rubber rollers; this gave a printing mould ready for placing in the press and printing from in gelatinous ink.

Experiments in photo-lithography had been made by Asser of Amsterdam in 1859, and by Osborne of Melbourne in 1860; but to Col. Sir H. James, R.E., F.R.S., and Captain de Courcy Scott, R.E., must be given the credit of having introduced in the early part of 1860 a thoroughly satisfactory process of photo-lithography which is still in use, with but slight modifications, in the Ordnance Survey Department at Southampton. The process is as follows:—Tough paper is floated on a solution of gelatine and potassium bichromate, dried, and then printed for two minutes in sunshine under a negative of a map or line drawing. The gelatine film is then covered with a thin layer of greasy lithographic ink, and the inked print is floated face up on water at 90° Fahr., until the soluble portions of the gelatine film absorb sufficient water, when the surface is gently washed with a sponge and a stream of warm water. When the soluble gelatine and the ink overlying it have been washed away, the paper is dried, then inked up and transferred to stone or prepared zinc, and printed in the usual lithographic manner.

Another somewhat similar process, in which prints are taken on paper direct from the inked surface of the gelatine, is called 'Collotype'; it is, however, difficult to work with certainty of result except under conditions of dryness and evenness of temperature.

Photographic engraving processes are divided into two sections, one relating to the making of intaglio plates which are printed in the same way as mezzo-

tint or etched plates, and the other relating to the making of relievé or surface-printing blocks which are printed on the typographic press.

Amongst the earliest inventors of intaglio photo-engraving processes must be named Nicéphore de Niepce, whose method of reproducing line engravings on copper plates has already been described; and H. Fox Talbot, F.R.S., who patented, in 1852, an intaglio process which was undoubtedly the pioneer of one of the most successful methods in use at the present time. The following is a brief resumé of Talbot's process as further improved by him in 1858, and entitled 'Photoglyphic Engraving':—A polished plate of copper or steel is coated with a thin film of gelatine sensitized with potassium bichromate, and after drying, it is exposed to sunlight under a 'positive' transparency (the reverse of a 'negative'); the surface of the film is then powdered evenly with finely-ground gum copal, the plate is held horizontally, and heated over a spirit-lamp so as to just melt the resinous powder. After cooling, the plate is etched by placing it successively in three baths of perchloride of iron of different strengths, beginning with a saturated solution, next a weaker solution, and the last a mixture of equal parts of water and saturated solution. The mordant penetrates first the portions of the gelatine which have been least acted upon by light, and proceeds in proportion to the light and shade of the original photograph, until, when the extreme high lights alone are left unetched, the plate is removed from the mordant, and the gelatine film removed by rubbing the surface with cotton-wool under running water. The plate is now ready for printing in the copper-plate press. Some remarkably fine engravings were produced by Mr. Fox Talbot, which cannot be excelled at the present day for sharpness and delicacy of detail in the lighter parts, though they lacked richness in the deeper shades.

Talbot's process was improved on by Karl Klic of Vienna, who employed a negative by Swan's carbon process developed on the copper plate which he had previously 'grained' with powdered bitumen. This is the method now in most general use.

Another intaglio process is electrolytic, and is based on Dr. J. W. Swan's patent of 1865, in which he describes the use of a tissue of gelatine mixed with charcoal or other chemically-inert grit, which was sensitized, printed under a negative, and developed as in the carbon process, but on a metal plate. The surface of the film, which was of thickness varying with the light and shade of the original, was rendered conductive by treatment with plumbago or by silvering, the plate was then placed in an electrolytic bath, and copper was deposited on the film until sufficient thickness to make a printing plate was attained. The particles of charcoal or grit in the tissue gave a 'tooth' or ink-holding property to the electrolytic plate. This process was subsequently experimented with by Woodbury, Waterhouse, Sawyer, and Foxlee, and was carried to a state of commercial and technical perfection by M. Roussillon (of Goupil et Cie.), by whom it was called 'Héliogravure'.

Relievé surface-printing blocks, now commonly known as 'half-tone blocks', are the outcome of the inventions of Fox Talbot, Burnett, von Egloffstein, Bullock, Swan, and Ives. Without entering into the history of its gradual development, it will suffice to give a brief description of the half-tone process as at present practised.

As typographic printing is done from the ink spread on the surface of the blocks, and every part of the block which is 'type high' prints black—the lower portions not printing at all,—it is evident that

the shades of a photograph between extreme black and white can only be approximately reproduced as intermediate tones by splitting up the blacks into lines or dots of various size, on a similar principle to that involved in making wood-cuts. This is effected by the use of a screen or grating of opaque crossed lines, 100 to 200 to the inch, ruled on glass.

The drawing or photograph to be reproduced is brightly illuminated by electric light and photographed on a wet collodion plate, which has a lined screen placed parallel to, and within $\frac{1}{2}$ inch of it, a prism or reversing mirror being used on the lens to prevent the reversal of the finished result. On development, it is observed that a negative has been obtained consisting of opaque black dots varying in size in inverse ratio to the lights and shades of the original drawing or photograph. The light that is reflected from the highest lights of the original has caused such a powerful action on the negative that the black dots are so large as to join together. In the true half-tones or grays the black dots are of equal size to the clear spaces between them—as in the squares of a chess-board, whilst in the portions of the negative represented by the darkest parts of the original the dots are as small as pin points.

After clearing and intensification, the negative is dried and varnished, and is then ready for printing on metal. A solution of albumen, gelatine, or glue is sensitized with potassium bichromate and poured on the polished surface of a copper plate. The film is then dried, while the plate is 'whirled', face downwards, over the flame of a Bunsen burner.

The sensitized plate is exposed under the 'screen' negative for a few minutes to sunlight or the electric arc light, washed in cold water, dried in methylated spirit, and then heated, film upwards, over a Bunsen flame until the picture has changed to a dark-brown colour—which indicates that a hard, acid-resisting enamel has been formed.

When cool, the plate is etched in a strong solution of perchloride of iron, until the dots in the high-lights of the picture are as fine as needle points. After washing and drying, a proof is then pulled from the plate on a typographic hand-press, and if local etching or hand-engraving be necessary, that is done, and the plate is cut round the edges to form a bevel, and mounted on mahogany or oak, so as to be 'type-high'. The half-tone 'block' can now be fixed in a form with other blocks and type-matter and printed on a typographic press at the rate of 1200 to 1500 impressions per hour.

Colour Photography.—Ritter and Seebeck, in their experiments with silver chloride, noticed the difference in the chemical action of the various rays of the spectrum, the latter observing in 1810 that the chloride reproduced to a considerable degree the actual colours of the spectrum; brownish violet, blue, pale-yellow, and rose being the actual tints produced. Wollaston was experimenting in England about the same time with the action of the spectrum rays on gum guaiacum, as well as silver chloride. N. de Niepce observed on his bitumen films traces of the colour effects, afterwards explained by Lippmann. Sir John Herschel, Hunt, and Becquerel made further advances; but to Zenker of Berlin, Carey Lea, and Lippmann of Paris is due the realization of a practical process of direct heliochromy, by the method known as the 'interference' method. The principle on which Lippmann's process is based is that a film of any transparent substance which is situated between media of higher and lower refractive power respectively will show, by reflection, a colour corresponding to that of light having a wavelength equal to double the thickness of the film.

Professor Lippmann coats a glass plate with a

transparent and grainless film of gelatino-bromide or albumeno-iodide of silver, places it in the camera so that the light passes through the glass plate before it reaches the film, which is backed by a layer of mercury, forming a mirror in contact with the sensitive film. It is then exposed, developed, washed, and dried in the usual way. When the plate is placed on black velvet, and viewed by vertical incidence, a coloured representation of the original photographed is seen; but there is a curious metallic hue about the colours, suggesting the automatic selection of the nearest pure spectrum colour to each particular colour in the original, which prevents the effect from being wholly satisfactory to the eye as a faithful transcript of natural colour.

Another method of colour photography, and one which has produced a far greater approximation to truth in colour rendering, is known as the 'Three-Colour Process', and is due to the application of photography to the theory of colour vision promulgated at the beginning of last century by Dr. Thomas Young. (See COLOUR.) This theory of the existence of three fundamental colour sensations, red, green, and violet, was revived and supported by Professor Helmholtz, and carried further by Professor Clerk-Maxwell, who described the results of his valuable practical and theoretical researches in a paper read before the Royal Institution in 1861, in which he suggested taking three photographs to represent the three fundamental colours, and then optically blending them to show the colours as well as the forms of objects. The same principle was patented in 1868 by Ducos du Hauron, who made earnest efforts to reduce it to practice, with but partial success.

The final solution of the problem is due to Frederic E. Ives of Philadelphia, who, by the application of a new and definite principle of colour selection in 1888, and by the subsequent invention of adequate devices for carrying out the process in a simple manner, has realized a perfectly successful and practical means for reproducing the colours of nature by photography.

Mr. Ives has devised a camera by means of which the rays of light, after passing through the lens, are split up into three sets, one set being filtered through red glass, another through green, and another through violet, producing three separate negatives on different parts of a single dry plate. These three negative images represent the effect of the three fundamental colour sensations, and a triple positive on glass, made therefrom by contact printing on another dry-plate, is placed in an instrument which Mr. Ives calls a 'Krömsköp', into which one looks and sees a marvellously true representation of the object photographed, in all its beauty and subtlety of colouring.

Modifications of Ives's process were devised by Dr. Joly of Dublin, and Professor Wood of Wisconsin University, the former using glass screens ruled with transparent inks of red, green, and violet, and the latter using diffraction gratings.

A very important development of the three-colour process is the application of photo-mechanical methods to the production of prints in colour. Ives's process is followed up to the point of the production of the three positives representing the three-colour sensations. Half-tone blocks are made from these in the ordinary way, but the lined screen is turned 30° between the taking of each 'process' negative. The three primary pigments or printing-inks are the complementaries of the three primary colour-sensations, so that the block produced from a negative taken through red glass must be printed in cyan-blue ink, that taken through green glass in magenta-pink, and that taken through violet glass in pale primrose-yellow.

Fig. 1 on Plate I. is the yellow print; fig. 2, the pink printed over the yellow; fig. 3, the blue separately; and fig. 4 is the final result of the three, superposed.

Amongst the later developments of photography, the 'cinematograph', for the production of so-called 'living pictures', takes a prominent place. It is difficult to over-estimate the importance of a photographic record of historical functions, which will not only enable future generations to see the portraits of celebrities at some critical moment, but which will make it possible to reproduce the action of the whole function, the prancing of horses, the glitter of swords, the waving of hats and handkerchiefs, the gracious bearing of the sovereign, and the thousand-and-one incidents in the scene! We understand that the British Museum authorities have arranged for the safe storage of films containing scenes of historical interest.

The cinematograph is called by about fifty other names, and manufactured in designs as diverse, but the general principle is much the same in all: a long band of celluloid, coated with the most rapid dry-plate emulsion, being arranged so as to be wound from one roller on to another in a special camera fitted with an automatic shutter which exposes the film stretched between the rollers, and the instant the exposure is over, the shutter covers the lens during the time a fresh surface of the film is wound into position. The average speed of the exposure is 720 per minute. After development, a positive film is made from the negative film, and the former is placed in a projection lantern, with a system of movement of film and shutter similar to that employed on the camera. By adjusting the speed of the film so as to correspond with the rate of the original negative film, there is given on the screen a faithful representation of the original scene. See CINEMATOGRAPH.

Cameras for taking panoramic views, embracing nearly a semicircle, date back to the daguerreotype days, when Puchberger of Retz and Martens of Paris constructed apparatus for use with curved plates and a rotating lens. Now that celluloid films are so largely used, there are several excellent and portable panoramic cameras in use, notably one made by the Kodak Co.

For rapid surveying, where lack of time or other causes prevent the use of ordinary surveying instruments, the photo-theodolite is invaluable. That invented by Mr. Bridges-Lee is largely employed in the government surveys of many countries. Each negative obtained by this instrument carries on its film the following information, which can be used at any subsequent time for making maps:—The median vertical plane, the horizon of the instrument, the principal point of the picture, the magnetic bearing of the principal plane, and a scale of horizontal angular distances right and left of the principal plane.

Of cameras generally, much has been done recently in reducing the weight and permitting of every possible movement of front and back. The studio portrait camera of to-day has changed but little from that known to our fathers; a typical example is shown in Pl. II. fig. 1. For general landscape and architectural photography a favourite type of camera is illustrated in fig. 2. A very good form of pocket camera is shown in fig. 3, which can be adapted for using glass plates or rollable film, and in fig. 4 for rollable film only. Of hand cameras, among the best and most popular are those made by Newman & Guardia, Shew & Co., R. & J. Beck, and the Kodak Co.

In fig. 5 is shown one of Beck's 'Frena' cameras,

which carries forty flat films like a pack of cards; the changing mechanism is both simple and efficient.

The stops or diaphragms of lenses are usually marked in accordance with a system which indicates the relative exposure necessary with each stop. Whether the stops are of the separate type, known as 'Waterhouse' diaphragms, the rotating type, 'wheel' diaphragms, or the latest type, called 'iris' diaphragms, it is usual to mark on each stop, or its equivalent position on the lens tube in the case of the 'iris' diaphragms, the letter 'F' followed by a line and a number. Take, for example, the case of the largest stop of a rapid rectilinear lens, which is marked 'F/8'; this signifies that the ratio between the focal length of the lens and diameter of the diaphragm aperture is as 1:8, i.e. 8 inches focal length and 1 inch working aperture, or in that ratio. Thus, with 'F/16', as the time of exposure is proportional to the square of the numbers, it would be necessary to give four times the exposure required with F/8.

The 'focal length' of a lens of the doublet or rectilinear type may be approximately taken as the distance between the diaphragm in the lens and the ground glass of the camera when focussed on a distant object.

In many types of hand camera it is usual to employ what is termed a 'fixed-focus' lens; that is, a lens fixed at such a distance from the plate that all objects 10 or 12 feet away from the camera are in focus. With such a camera it is possible to take sharp photographs of objects nearer than the above-mentioned distance by placing a 'magnifier', or spectacle lens, in front of the fixed lens on the camera, and these are generally supplied by the makers of the cameras.

Lenses have been much improved since the introduction of 'Jena' glass in 1885; the 'Anastigmats' made with this glass have a greater rapidity than older forms, extreme fineness of definition over an extended area of illumination, freedom from astigmatism, and they are very compact. Fig. 6 shows the Dallmeyer 'stigmatic' portrait lens (F/4); fig. 7, the Ross wide-angle symmetrical lens (F/16) for landscape and architectural views; fig. 8, the Zeiss 'anastigmat' lens (F/8) for outdoor portrait and landscape work. Wray's 'cinematograph' lens (F/2) is one which is used both for the camera and the projection lantern.

The latest invention in lenses is the 'Fluid Lens' of Dr. Grün, in which a fluid of high refractive power is inclosed between the lens combinations.

This lens will work at F/1, that is to say, with a focal length equal to the working aperture; consequently it is possible with it to take photographs in theatres solely by the ordinary light of the footlights and limelight, with an exposure of less than a second.

Photographs of landscapes can be taken with Dr. Grün's lens at midnight on moonless nights in thirty seconds.

By the use of the tele-photo lens of Dallmeyer one is enabled to obtain enlarged images of distant objects; it consists of a tube with an ordinary photographic doublet in front and an achromatic negative lens system behind.

The advantages of photography are becoming daily more manifest, whether we consider it in an artistic, social, or educational point of view. Its widest and most popular range of usefulness is in the production of portraits, the depicting of landscapes and natural scenes, and in preserving records of ancient buildings and monuments. Photographs of the most celebrated works of art, whether in painting or sculpture, may now be multiplied indefinitely; and in the case of statuary, when taken binocularly and

viewed through the stereoscope, may be studied as if the originals were present. In all departments of science this art has become an important auxiliary; the zoologist, the botanist, the astronomer, the architect, and the engineer find its aid invaluable.

In concluding this short account of the history and practice of photography, we must refer to that use of the art which will ever be the most wonderful and sublime of its applications—photography of the heavenly bodies. Not to mention the beautiful photographs that astronomers have obtained of the sun, moon, and nearer planets, there is the great photographic map of the heavens, which reveals to us myriads of stars that the human eye has never seen, and which, by the aid of the most powerful telescope, can never be seen; but the feeble rays from the suns in the remotest immensities of space, though insufficient to affect our organs of sight, can, by lapse of hours, be made to record on the sensitive photographic plate not only their form, but their spectra, which denotes their composition.—Among the numerous treatises on the subjects dealt with in this article we may mention the following: Brothers's Photography (1892); Abney's Treatise on Photography (1878); Meldola's Chemistry of Photography (1889); Harrison's History of Photography (1888); Vogel's Practical Pocket-Book of Photography (1893); Schnauss's Collotype and Photo-Lithography (1889); Leaper's Materia Photographica (1891); Taylor's Optics of Photography (1892); Wilkinson's Practical Guide to Photo-mechanical Processes (1892); Werge's Evolution of Photography (1890); Monpillard's La Microphotographie (1899); Clerc's La Photographie des Couleurs (1899); Von Hübl's Die Dreifarbenphotographie (1897).

PHOTOMETER, an instrument intended to indicate relative quantities of light, as in a cloudy or bright day, or to enable two light-giving bodies to be compared. A photometer in common use was invented by Bunsen; it consists of a screen of thin paper moistened with a solution of spermaceti in turpentine, except a spot in the centre. This screen being placed on a stand at a fixed distance from a source of light of constant intensity, the ungreased spot appears darker than the greased part. One of the lights to be compared is then placed in front of the screen, and adjusted at a distance such that the ungreased spot is illuminated as much as the rest of the screen. A similar experiment being made with the other light to be compared, the intensities of the two are to one another in the proportion of the squares of the distances from the screen at which the lights must be placed in order to cause the disappearance of the ungreased spot.

PHOTOPHONE, an instrument invented in 1880 by Prof. Graham Bell, which resembles the telephone except that it transmits sounds by means of a beam of light instead of the connecting wire of the telephone. The success of the instrument depends upon a peculiar property of the rare metal selenium, that, namely, of offering more or less opposition to the passage of electricity according as it is acted upon or not by light. In its simplest form the apparatus consists at the receiving end of a plane mirror of some flexible material (such as silvered mica) upon which a beam of light is concentrated, and the voice of a speaker directed against the back of this mirror throws the beam of light reflected from its surface into undulations which are received on a parabolic reflector at the other end, and are centred on a sensitive selenium cell in connection with a telephone, which reproduces in articulate speech the undulations set up in the beam of light by the voice of the speaker. For the beam of light employed the sun is obviously the best source, but artificial light is also available,

the oxy-hydrogen lamp having proved almost equally effective. It was at one time believed that the instrument might be utilized in circumstances such as those in which the heliograph has been found useful; in enabling, for instance, communications to be carried on between bodies of troops at some distance from each other, or between the shore and vessels at sea. But the practicable distance of transmission is much too small for this.

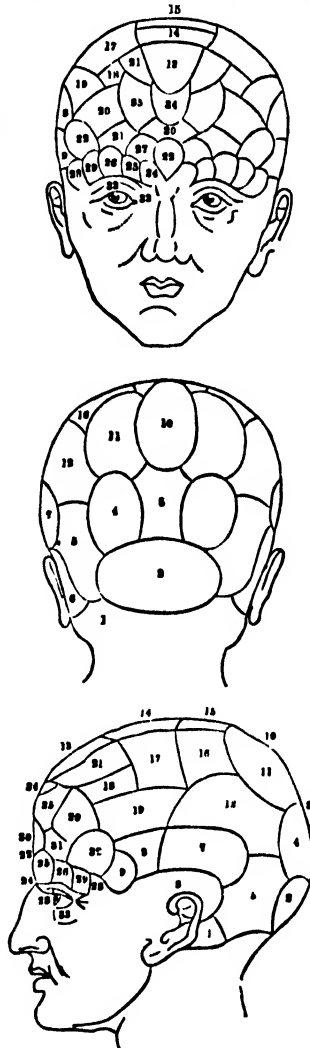
PHRASE. See MUSIC.

PHRENOLOGY (Greek, *phrên*, mind, *logos*, discourse), the term applied to a theory or would-be science, which claims that the mental powers, faculties, or phenomena can all be assigned to special regions of the brain, and that the whole human cranium can be mapped out into corresponding sections, each section representing the dwelling-place in the brain of a certain faculty, propensity, or sentiment. Dr. Gall, a German physician, was the first to start this so-called science; but to Dr. Spurzheim, it was mainly indebted for its systematic arrangement, and to George and Andrew Combe of Edinburgh for its advocacy. Dr. Gall commenced giving private lectures on the subject in 1796, but the Austrian government took alarm at his novel doctrines, and prohibited his lectures. In 1800 he was joined by Dr. Spurzheim, who continued his colleague till 1813, both conducting their researches in common. They travelled together from place to place, visiting prisons and examining criminals of every description, for the purpose of extending or confirming their theories, and lecturing occasionally, with the view of paying expenses or gaining proselytes. In Paris a commission was named by the Institute to report upon their labours, and after much patient investigation an unfavourable report was drawn up by the celebrated Cuvier. Gall settled in Paris in 1807, and was successful in making many converts there. He also visited Britain. In 1814 Spurzheim proceeded to London, where he delivered two courses of lectures to small audiences. At Bath, Bristol, Dublin, and Cork, where he also delivered lectures, he was equally coldly received; but at Edinburgh he was so successful that it soon became the head-quarters of phrenology in Britain. George Combe of this city must be allowed to have been one of the best expounders and defenders of phrenology. Spurzheim returned to London, thence to Paris, and did not visit Britain again till 1825. Societies with collections of skulls, casts of heads, &c., had by this time been established in almost every considerable town, and Spurzheim was now warmly received wherever he went—at London, Liverpool, Manchester, Hull, Exeter, Dublin, Cork, Glasgow, Paisley, Dundee, &c. Among his followers were included, Sir George Mackenzie, Whately, Macnish, Laycock, and others. He eventually went to America, where he died in 1832. In America phrenology found an immense number of converts, among its chief advocates being, the brothers O. S. and L. N. Fowler, and S. R. Wells. It is still far more popular in the United States than in Britain, where, indeed, it is now regarded with comparatively little interest, though a good many 'professors' manage to make some money out of it.

Although Dr. Gall was the founder of phrenology, and although he was the discoverer of twenty-seven organs out of thirty-five, he is generally admitted to have been deficient in forming a system, or in deducing from it philosophical data. Dr. Spurzheim is said by phrenologists to have contributed most to the advancement of the science, by enriching it with important discoveries, by arranging it into a system, and by showing how it might be applied to many interesting purposes connected with the human mind. We shall here give a list of the twenty-seven organs

discovered by Dr. Gall, with the titles he affixed to each. These titles, it will be observed, differ chiefly from those of Dr. Spurzheim in being less comprehensive in their character, and therefore less pliable in representing the various faculties and dispositions of man. For example, what Gall called *murder*, Spurzheim calls *destructiveness*, thus including in it a desire to destroy noxious animals, and to kill for food; and while Gall has a bump for *veneration* and one for *religion*, Spurzheim confines himself to *veneration*, saying it includes not only a propensity to venerate God, but to venerate wealth, power, or any distinguished personage.

The following is Dr. Gall's list:—No. 1, the instinct of veneration. No. 2, the love of offspring. No. 3,



friendship. No. 4, courage, self-defence. No. 5, murder. No. 6, cunning. No. 7, the sentiment of property. No. 8, pride, self-esteem, haughtiness. No. 9, vanity, ambition. No. 10, cautiousness. No. 11, the memory of things, the power of being educated. No. 12, local memory. No. 13, the memory of persons. No. 14, verbal memory. No. 15, memory

for languages. No. 16, colours. No. 17, music. No. 18, number. No. 19, aptitude for the mechanical arts. No. 20, aptitude for drawing comparisons. No. 21, aptitude for drawing conclusions. No. 22, wit. No. 23, poetry. No. 24, good-nature. No. 25, mimicry. No. 26, religion. No. 27, firmness of character. The figures in this list have no relation to those referred to below.

Dr. Spurzheim's arrangement of the faculties is comprised in orders, genera, &c. We subjoin a phrenological chart, together with Dr. Spurzheim's list of the organs, taken from Combe's Elements of Phrenology.

ORDER I.—FEELINGS.

Genus I.—PROPENSITIES—common to Man with the Lower Animals.

1. AMATIVENESS.—Produces sexual love.
 2. PHILOPROGENITIVENESS.—Uses: Love of offspring.—Abuses: Pampering and spoiling children.
 3. CONCENTRATIVENESS.—Uses: It gives the desire for permanence in place, and for permanence of emotions and ideas in the mind.—Abuses: Aversion to move abroad; morbid dwelling on internal emotions and ideas, to the neglect of external impressions.
 4. ADHESIVENESS.—Uses: Attachment, friendship and society result from it.—Abuses: union for improper objects, attachment to worthless individuals. It is generally strong in women.
 5. COMBATIVENESS.—Uses: Courage to meet danger, to overcome difficulties, and to resist attacks.—Abuses. Love of contention, and tendency to provoke and assault. This feeling obviously adapts man to a world in which danger and difficulty abound.
 6. DESTRUCTIVENESS.—Uses: Desire to destroy noxious objects, and to kill for food. It is very discernible in carnivorous animals.—Abuses: Cruelty, desire to torment, tendency to passion, rage, harshness and severity in speech and writing. This feeling places man in harmony with death and destruction, which are woven into the system of sublimary creation.
 - 6a. ALIMENTATIVENESS, or appetite for food.—Uses: Nutrition.—Abuses: Gluttony and drunkenness. This organ is considered only probable, and is not marked on the chart; it is situated between Nos. 6 and 9.
- LOVE OF LIFE is a conjectural propensity, also left unmarked. Combe suggests that this organ is probably a convolution at the base of the middle lobe of the brain, the size of which cannot be ascertained during life.
7. SECRETIVENESS.—Uses: Tendency to restrain within the mind the various emotions and ideas that involuntarily present themselves, until the judgment has approved of giving them utterance; it is simply the propensity to conceal, and is an ingredient in prudence.—Abuses: Cunning, deceit, duplicity, lying, and, joined with acquisitiveness, theft.
 8. ACQUISITIVENESS.—Uses: Desire to possess, and tendency to accumulate articles of utility, to provide against want.—Abuses: Inordinate desire for property; selfishness; avarice.
 9. CONSTRUCTIVENESS.—Uses: Desire to build and construct works of art.—Abuses: Construction of engines to injure or destroy, and fabrication of objects to deceive mankind.

Genus II.—SENTIMENTS.

I. Sentiments common to Man with the Lower Animals.

10. SELF-ESTEEM.—Uses: Self-respect, self-interest, love of independence, personal dignity.—Abuses: Pride, disdain, overweening conceit, excessive selfishness, love of dominion.
11. LOVE OF APPROBATION.—Uses: Desire of the esteem of others, love of praise, desire of fame or glory.—Abuses: Vanity, ambition, thirst for praise independently of praiseworthiness.
12. CAUTIOUSNESS.—Uses: It gives origin to the sentiment of fear, the desire to shun danger, to circumspicion; and it is an ingredient in veridience.—Abuses: Excessive

timidity, poltroonery, unfounded apprehensions, despondency, melancholy.

13. BENEVOLENCE.—Uses: Desire of the happiness of others.—Abuses: Profusion, injurious indulgence of the appetites and fancies of others, prodigality, facility of temper.

II. Sentiments proper to Man.

14. VENERATION.—Uses: Tendency to worship, adore, venerate, or respect whatever is great and good; gives origin to the religious sentiment.—Abuses: Senseless respect for unworthy objects consecrated by time or situation, love of antiquated customs, abject subserviency to persons in authority, superstition.
15. FIRMNESS.—Uses: Determination, perseverance, steadiness of purpose.—Abuses: Stubbornness, infatuation, tenacity in evil.
16. CONSCIENTIOUSNESS.—Uses: It gives origin to the sentiment of justice, or respect for the rights of others, openness to conviction, the love of truth.—Abuses: Scrupulous adherence to noxious principles when ignorantly embraced, excessive refinement in the views of duty and obligation, excess in remorse, or self condemnation.
17. HOPE.—Uses: Tendency to expect and to look forward to the future with confidence and reliance; it cherishes faith.—Abuses: Credulity, absurd expectations of felicity not founded on reason.
18. WONDER.—Uses: The desire of novelty, admiration of the new, the unexpected, the grand, the wonderful, and extraordinary.—Abuses: Love of the marvellous, astonishment.—Note: Veneration, hope, and wonder combined give the tendency to religion; their abuses produce superstition and belief in false miracles, in prodigies, magic, ghosts, and all supernatural absurdities.
19. IDEALITY.—Uses: Love of the beautiful and splendid, the desire of excellence, poetic feeling.—Abuses: Extravagance and absurd enthusiasm, preference of the showy and glaring to the solid and useful, a tendency to dwell in the regions of fancy, and to neglect the duties of life.
20. WIT.—Gives the feeling of the ludicrous.
21. IMITATION.—Copies the manners, gestures, and actions of others, and nature generally.

ORDER II.—INTELLECTUAL FACULTIES.

Genus I.—EXTERNAL SENSES.

- | | | |
|------------------|---|---|
| FEELING or TOUCH | { | Uses: To bring man into communication with external objects, and to enable him to enjoy them.—Abuses: Excessive indulgence in the pleasures arising from the senses, to the extent of impairing the organs and debilitating the mind. |
| TASTE | | |
| SMELL | | |
| HEARING | | |
| SIGHT | | |

Genus II.—INTELLECTUAL FACULTIES—which perceive existence.

22. INDIVIDUALITY—Takes cognizance of existence and simple facts.
23. FORM—Renders man observant of form.
24. SIZE—Renders man observant of dimensions, and aids perspective.
25. WEIGHT—Communicates the perception of momentum, weight, resistance, and aids equilibrium.
26. COLOURING—Gives perception of colours.

Genus III.—INTELLECTUAL FACULTIES—which perceive the relations of external objects.

27. LOCALITY—Gives the idea of space and relative position.
28. NUMBER—Gives the talent for calculation.
29. ORDER—Communicates the love of physical arrangement.
30. EVENTUALITY—Takes cognizance of occurrences and events.
31. TIME—Gives rise to the perception of duration.
32. TUNE.—The sense of melody arises from it.
33. LANGUAGE—Gives a facility in acquiring a knowledge of arbitrary signs to express thoughts, readiness in the use of them, and a power of inventing them.

Genus IV.—REFLECTING FACULTIES—which compare, judge, and discriminate.

34. COMPARISON—Gives the power of discovering analogies, resemblances, and differences.
35. CAUSALITY—Traces the dependences of phenomena, and the relation of cause and effect.

PHRYGIANS, the name of early inhabitants of Asia Minor, applied not only to the Trojans but also to the Mysians and Lydians. They appear to have been of Aryan speech and to have passed over from Europe into Asia. Under the Persian dominion Phrygia was the largest and most central province of Asia Minor. At a later period it was divided into Greater and Lesser Phrygia, the latter along the shore of the Hellespont, the former in the centre of Asia Minor. The principal cities were Apamea, Laodicea, and Colossæ. The inhabitants of this fertile region were early civilized, and paid much attention to grazing and tillage. Little is known of the early history of Phrygia. Several of its kings are mentioned of the names of Gordius and Midas. On the death of Adrastus (B.C. 560) the royal family of Phrygia became extinct, and the kingdom became a province of Lydia. It afterwards formed a part of the Persian, and still later of the Roman Empire. In the music of the ancients the *Phrygian mode* was of a martial character. See the Cities and Bishoprics of Phrygia (1895-97) and The Historical Geography of Asia Minor (1890) by Prof. W. M. Ramsay, and also other works by the same scholar.

PHRYNE, one of the most celebrated courtezans of Greece, born at Thespiæ in Boeotia. She arrived at Athens in a humble condition, but soon began to acquire wealth by trafficking in her charms. She became the mistress of Praxiteles and of Hyperides; the former of whom immortalized her beauty by his art; the latter obtained her acquittal when she had been accused of atheism by exposing her charms to the aged judges of the Helicæa. She became so wealthy that she offered to rebuild the walls of Thebes if the citizens would allow the inscription, 'Alexander destroyed them; Phryne, the courtesan, rebuilt them', to be put on them. The Thebans declined the offer. At Eleusis she went naked into the sea before the assembled multitude, but this was probably to renew the impression of her charms. (See ANADYOMENE.) Even in her old age she was not without admirers.

PHRYXUS. See ARGONAUTS, ATHAMAS, and HELLE.

PHTHISIS. See CONSUMPTION.

PHYLACTERY, among the Jews, a sort of small box containing four passages from the Pentateuch, namely, Exodus xiii. 1-10, 11-16, Deuteronomy iv. 4-9, xi. 13-21. The phylactery or *tephillah* consists of a small leather case or capsule fastened to a band, and each male Jew of thirteen years of age and upwards wears two of them at morning and evening prayer. One is bound round the head in such a way that the capsule comes between the eyebrows, the capsule in this case being in four compartments, each containing a strip of parchment with one of the four passages above mentioned. The other band with a simple phylactery is fastened round the left arm, the little case being turned towards the heart. The practice of wearing these *tephillin* was developed out of the commands in Exodus xiii. 9 and 16, and Deuteronomy vi. 8, and in its present form dates from about the first century before the Christian era. In Matthew xxiii. 5, Jesus condemns the Pharisees for making broad their phylacteries. The name phylactery, from a Greek word meaning 'to guard', refers to their use as amulets for protection against demons.

PHYLLOPODA ('leaf-footed'), an order of Crustacea possessing numerous feet, from about fourteen up to sixteen in number. The feet are of *foliaceous* or leaf-like structure, and are provided with *branchial* appendages, for the purpose of respiration. The 'carapace', or shell-like covering protecting the head and chest, may be well developed, or the body

may be destitute of a covering. The eyes may be distinct; but in some cases they are more or less confluent or united, and are borne on feebly-defined stalks. There are a pair of mandibles, two pairs of maxillæ; and in some forms a pair of maxillipeds ('foot-jaws'). Two pairs of antennæ are almost always present. The first pair of legs are natatory in character, and possess bristle-like filaments. In their development the Phyllopoda pass through a metamorphosis; and in their earliest state the embryos appear as Nauplii (see NAUPLIUS)—that is, as unsegmented larvæ, which do not possess a carapace, and which are provided with a single median eye. The eggs of almost every species have a remarkable power of resisting desiccation.

All the Phyllopoda are of small size. They are classified in the three families Limnadiæ, Apodidæ, and Branchipodidæ. The third family is represented by the familiar 'Fairy Shrimps' (*Chirocephalus diaphanus*), met with in fresh-water ponds, which possess clear, delicate bodies, and swim through the water back downwards. The curious 'Brine Shrimps', found in the brine-pans of salt-works, and in the salt lakes of both the Old and New Worlds, are also comprised within this family. The *Artemia salina* or 'Brine Shrimp', found in the Lymington salt-pans, exemplifies these latter forms. In 1874 a Russian naturalist, Schmunkewitsch, found that as the salinity of the water increased *A. salina* became transformed into *A. Mukhlhausenii*, and that by diluting the brine it could be changed into a species of another genus, *Branchinecta*. An allied form, *Branchipus stagnalis*, is found in pools and ruts. The genera *Limnadia* and *Apus* differ from *Branchipus* and *Artemia* in possessing a distinctly-developed carapace. In *Limnadia* the carapace exists in the form of a shelly structure composed of two pieces, and which opens along the ventral or lower aspect of the animal. In the genus *Apus*—the species of which occur in great numbers in ponds and ditches after heavy rains—the carapace has the form of a shield, enclosing the anterior parts, and the front portion of the abdomen also. The Phyllopoda are represented as fossils in rocks extending from Paleozoic to Tertiary times.

PHYLLOXERA, a genus of insects noted as causing amongst the vines of France and other countries a serious form of disease. The Phylloxera unquestionably originated from the United States of America, although this statement is denied, as will hereafter be noticed, by some naturalists. Mr. Fitch, an American entomologist, being charged in 1854 by the state of New York to report on the insects beneficial or injurious to the agriculture and crops of the state, discovered on the leaves of vines numerous small gall-like excrescences. These 'galls' were situated on the lower surface of the leaves, and each excrescence appeared to open at its apex or upper part by a small aperture, the margin of which was surrounded by hair-like filaments. Within each gall, and at its lower portion, a small insect was found. This creature possessed a rounded convex body, short legs, and a suctorial form of mouth. The antennæ were filiform and obtuse. These insects were invariably found to be *female*, and the eggs produced by each numbered several hundreds. A study of the genesis of these insects showed that the eggs gave origin to larvæ, which ascended to the upper parts of the vines. Each larva in its turn, by biting or eroding the plant-surfaces, produced a new gall, in which it speedily became inclosed in the same manner as the parent. Mr. Fitch, comparing the galls and the entire life-history of the vine-insect to the galls seen in the leaves of the elm-tree and poplar, and which are formed by various species of *Pemphigi*, named the

vine-pest *Pemphigus vitifoliae*. It was ascertained that the malformations thus produced on the vines did no apparent harm to vigorous and healthy plants.

Two other American entomologists, Mr. Benjamin Walsh and Mr. Charles Riley, also described the new *Pemphigus* of Fitch, and included it in the list of insects which were injurious and hurtful to the interests of the agriculturist. Dr. Henry Shimer, in 1867, describing the same galls and their included insects, also added the important observation that he had discovered an individual differing from those seen by his predecessors, which was provided with wings, and was considered by Shimer to be a *male*. This latter authority, therefore, separated the vine-pest from the genus *Pemphigus* of Fitch, and named it *Dactylophera vitifoliae*.

Meanwhile the so-called *Pemphigus* appeared on the other side of the Atlantic, being found in vineries at Hammersmith, near London, in 1863, and in other parts of England and Ireland in 1867-68. Mr. Westwood, studying the insect, assumed it to be an entirely new species, and named it *Perilymbia vitisana*. Westwood was fortunate enough to see the insect under forms in which it had not previously been noted. He thus found it on the leaves of the vines, in the galls, and also on the roots of the plants, existing in the latter condition in the form of a subterranean grub-like creature. Westwood's observations were not published until 1869, when the insect was found in the south of France.

Some years previously to 1869 a malady of unknown nature affected the vineyards on both sides of the Lower Rhône. At Pujault in Gard it had been vaguely met with in 1863. But in 1867 it had assumed so formidable proportions that the vine-growers of Le Comtat, of La Crau, of the Alps, and in the neighbourhood of Tarascon, began to take serious alarm for the welfare of their crops and industry. A vine-grower of Arles, M. Delorme, had described the outward appearances and symptoms of the vine-malady, without saying or suggesting anything as to its origin or cause; whilst the peasantry gave to the disease the name of *le blanquet* or 'rot'. The latter confounded the disease with a malady showing itself in vines planted by ingrafting them in oak. But it is needless to remark the new vine-malady was an entirely different affection from the 'rot' of the peasants. The *Phylloxera* causes a kind of gangrene or decay of the vine-roots; the gangrenous matter having a blackish colour, but possessing no odour of fungi, as is perceptible in 'rot'.

After 1867 the evil still increased. The Agricultural Society of Vaucluse and other allied bodies met in consultation in July, 1868, and applied themselves to the investigation of the phenomena of the disease in the vines. They discovered no insects, fungi, or parasites sufficient to account for the symptoms, although the sweeping and ever-extending progress of the malady through the vineyards seemed to point to a *living* cause as the origin of the epidemic. 'It marches like an army,' was the felicitous expression of a vine-grower in describing the ravages of the plague.

Marks of a yellow colour and some stains were, however, observed by the naked eye at the roots of vines, these marks being disclosed by the exposure of roots by the blow of an axe. Microscopic investigation of these markings showed that they consisted of a collection of insects with suctorial mouths; and further investigations of an analogous kind revealed the fact that insects of minute size, burrowing below ground, and multiplying by myriads, caused the strongest vines in time to succumb and decay.

The structural relations of these insects formed the next point to which the attention of naturalists

was directed. These wingless insects of the French vines were at first named by Professor Planchon of Montpellier *Rhizaphis*, or 'pests of the roots.' This latter investigator determined, however, to institute a close search for the winged form, which he believed should certainly exist; and accordingly he found it in the *pupa* or *chrysalis* state, with its wings still inclosed or in an imperfect state. On the 28th August, 1868, Professor Planchon saw this *pupa* hatched or enter the *imago* or perfect state. It then resembled an elegant little grasshopper, and was provided with four transparent wings. The name *Rhizaphis* was now changed to *Phylloxera* (literally, 'leaf-blasters'), under which designation the vine-pest has latterly continued to be known. Planchon further found it difficult to distinguish the *Phylloxera* of the vine from that of the white-oak leaves (*Phylloxera quercus*), which causes these leaves to assume a yellow appearance.

The relations of the Vine *Phylloxera* to the American insect described by Fitch and his fellow-naturalists were next investigated. On the 11th of July, 1869, Planchon discovered at Sorgues (Vaucluse), upon two branches of a variety of vine known as Tinto, several galls similar to those described as formed by the *Pemphigus* insect of America. At Bordeaux a few days afterwards M. Laliman discovered the same galls, but with the important addition, namely, that the Bordeaux galls were situated upon American vines, many of which carried *Phylloxera* on their roots also. Suspecting that the two forms of insects—namely, those of the leaves and those inhabiting the roots—were merely modifications of one another, the one being adapted for a subterranean and the other for an aerial existence, M. Lichenstein and M. Planchon at length arrived at the conclusion that the *Pemphigus vitifoliae* of Fitch was simply the *Phylloxera vastatrix* of France. This hypothesis received striking and important confirmation when it was ascertained that the *Phylloxera* of the galls became transformed in the course of development into those of the roots. And Riley, the American entomologist, coming to Europe, confirmed the identity of the *Phylloxera* of France with the American *Pemphigus*; and in America Riley in turn discovered the insects in their subterranean condition, that is, existing on the roots, just as previously they had been found in that continent infesting the leaves in the form of galls.

The question as to the original habitat of the *Phylloxera* naturally cropped up in order, after its structural relationships had been fully determined. The first theory of the European origin of the *Phylloxera* was set aside as improbable. The insect, if of European origin, should, under the ordinary run of circumstances, have been heard of long before its discovery; and animal plagues of so great and grave a character are not suddenly or spontaneously produced for the first time in a country which has previously been entirely free from their inroads and devastations. On this hypothesis also we should have to account for the spontaneous and simultaneous appearance of the insects in various regions very far removed from each other. Another theory, enunciated by M. Korossios of Athens, held that the insect was not new to Europe—that, in fact, it was the old *Phthir* or vine-insect described by Strabo, and which the modern Greeks still try to repress by means analogous to those employed in ancient times. The so-called *Phthir* is, however, a widely different insect from the *Phylloxera*. It is the *Dactylopius longispinus*, allied to the cochineal insects; and it attacks in spring the outer parts of the vines, and covers them with a syrupy fluid, amid which a cryptogamous plant known as *fumagine* develops itself.

This insect thus devastates the vines of the Mediterranean and Black Sea coasts. A third suggestion, emanating from M. Nourrigat of Lunel, maintained that this so-called Phylloxera disease had already ravaged Europe about the eighteenth century, and was identical with that termed by the Germans *Gabel*, or 'fork-disease', on account of the forked or bifurcate appearance observed in the branches of the affected vines. But this latter disease corresponds evidently to the *cotté* of Charente, or the *anthracnose* of Southern France, described by Esprit, Fabre, and Dunal.

That the Phylloxera is a native of, and indigenous to America forms the last hypothesis; and of the correctness of this opinion there can be little doubt. It has thus been only recently introduced into Europe from the American continent. In proof of this theory it may, firstly, be mentioned that the Phylloxera occurs very generally on the *wild* vines of America as well as on the cultivated varieties; and the Phylloxera galls were discovered on a specimen of the *Vitis monticola* (gathered in Texas in 1834) by Berlandier the botanist. Planchon relates that he himself saw this specimen in the herbarium of Dr. Engelmann of St. Louis, a man unrivalled as an authority on the American species of vines. The existence of Phylloxera in the United States has been verified for more than fifty years; and if documentary evidence could be obtained its history would be certainly found to extend to a period much further back. And considering that the culture of vines in the United States is a thing of comparatively recent date, that European vines do not grow well in America, and that whilst several American species can successfully resist it, none of the European species appear able to survive its attack—it is impossible after these facts to doubt that America has the credit of being the native region of the Phylloxera. Were it otherwise we should, firstly, have been aware in Europe of the ravages of the Phylloxera in former years, and the European vines should not have so inevitably and generally succumbed to its attack.

The proofs that the Phylloxera has been imported into Europe from America are also very clear. The entire circumstances attending the ravages of the Phylloxera point to its first appearing in any given district in the immediate neighbourhood of American vines. Thus in Gironde the Phylloxera appeared first at Floirac, near Bordeaux, in the centre of vines directly imported from America. From this point, as from a centre, it rapidly spread to adjoining vineyards, and since 1868 spread to still wider surroundings. In Austria the Phylloxera disease showed itself in a vineyard at Klosterneuburg, near Vienna, and appeared exactly at the spot where American vines had been planted. These vines had been directly imported from the United States.

Regarding the *conditions* which favour the growth and propagation of Phylloxera little can be definitely said or determined. Cold, drought, and other causes have been put forward as explanatory and favouring causes, but without adding any real knowledge of the phenomena. Vine-growers have meanwhile not been idle in trying to elucidate means for the destruction of the Phylloxera. Poisonous solutions of various kinds have proved effectual in destroying the insects; and various means, from saturating the plants with pure cold water, to using solutions such as gas-water, solutions of ammonia, sulphuretted hydrogen, carbolic acid, arsenic, &c., have been tried. Two great difficulties, however, are met with in the application of such remedies; the first of these being to apply the solution so as to kill the insects without injuring the plants; and secondly, to apply such measures on a scale sufficiently large to include whole vineyards, and at the same time to devote the neces-

sary attention to each individual plant. Vines appear to be particularly liable to be affected by the action of gases; and it may be stated as a general result that all attempts to fortify the vines, or to prevent the spread of the disease in this manner have as yet been futile.

An important observation, and one from which valuable results have been derived, was made in the years 1867-69 by M. Laliman, whose vineyard, situated near Bordeaux, had been almost completely devastated by the Phylloxera. This gentleman noticed that certain American vines flourished amidst those that succumbed to the disease. Led by this fact M. Laliman came to regard the healthy American vines as the proper species to replace those destroyed by the disease, and as likely to resist it in time to come. Mr. Riley of America, independently of M. Laliman's observations, was led to a similar conclusion; and M. Gaston Bazille, of Montpellier, suggested the idea of grafting European vines on those of America—a work which has already been attended with good results, although time alone can prove whether the vine-pest can be fully mastered, and its devastations as fully and completely repaired.

Since its appearance this insect pest has spread over vast areas in the vine-growing districts of France and the rest of Europe, and has inflicted immense losses on the owners of vineyards, more especially in France. By 1877 it had spread over twenty-eight of the French departments, and had completely destroyed the vines over an area of 750,000 acres, more than 900,000 acres besides being more or less affected. Nor have its ravages shown any signs of cessation, for the diminution in the aggregate area of wine-growing land in France still goes on, notwithstanding the many new plantations, both of native and American vines, in various parts of the country, and the more or less successful application of the best-known means for the prevention of the scourge. Thus it is estimated that owing to this pest the aggregate area of vineyards in France had up to 1891 decreased by about 1,700,000 acres notwithstanding that considerable areas have been planted with American vines. From 1875 to 1887 the total loss to France from destruction of vines was estimated at £280,000,000, besides money spent in importing foreign wines, &c. Few wine-growing countries are now entirely free from the Phylloxera.

PHYSETER. See WHALE.

PHYSICAL GEOGRAPHY is that branch of geography which treats of the surface of the earth, of the atmosphere which surrounds it, of the substances which compose it, and of the organized bodies which it produces or supports. (See GEOGRAPHY.) Physical geography does not, however, enter into the minute details of natural science; it gives a general view of phenomena and their mutual relations, and leaves to the more rigorous sciences the classification of the substances of which they treat, borrowing from each its results, and connecting them into one whole. The figure of the earth and its relations to the other parts of the universe are determined by mathematical geography; physical geography points out its natural divisions into land and water, continents, seas, oceans, &c., and treats of the external configuration of mountains, valleys, coasts, &c. Having examined the surface, we attempt to penetrate the interior, and determine the structure and composition of the solid parts of the earth, its strata, caverns, veins, &c.; the rocks or aggregate substances of which it is formed, their distribution, properties, age, &c.; we study the remains of its past inhabitants, and the proofs of the violent revolutions which it has undergone, and seek for the causes of those revolutions. (See GEOLOGY and PALÆONTOLOGY.) We next ex-

mine the simple substances of which the earth is composed (see MINERALOGY), and their various combinations, from which we obtain so many contributions to our comfort, health, or luxury. If we then turn to the fluid parts of the globe, hydrography points out its divisions into lakes, rivers, seas, oceans; determines the different natural qualities of water, its chemical properties, &c. (see OCEAN, WATER); and the nature, extent, and causes of those great fluctuations which it regularly undergoes. (See TIDES, CURRENTS.) The fluid which surrounds the globe may next be examined (see AIR, ATMOSPHERE, METEOROLOGY), its composition determined, and the curious phenomena of which it is the theatre, and the movements to which it is subject, be studied. After concluding our examination of inorganic nature by researches into the local temperature of the atmosphere (see CLIMATE), we may next consider the earth as the residence of organized living beings, which adorn its surface and feed upon its inexhaustible resources. Vegetables, from the abundance with which they are produced, and from their intimate connection with the surface of the globe, first attract attention; botany examines in detail the treasures of the vegetable world, while physical geography marks its general relations, and traces the influence of climate, temperature, soil, atmosphere, &c., upon the progress and extent of vegetation, and the geographical distribution of plants. (See BOTANY.) Rising above the lowest form of organic to animal life, we search the air, the land, and the sea, following the motions of insects, reptiles, birds, fish, and beasts; and fix the boundaries within which they are confined, or the spot of their origin, and the progress of their migrations. (See ANIMAL, ZOOLOGY, &c.) Man in his physical capacity, his animal organization, his variety of complexion, stature, conformation, and mode of life; the proportions of the ages, sexes, deaths, and births; with the influence of heat and cold, moisture and drought, local habitation and climate, upon his body and mind, is the last and highest subject of physical geography. (See ETHNOLOGY, MAN, &c.) See Somerville's Physical Geography; Humboldt's Cosmos; Cooley's Physical Geography; Johnston's Physical Geography; Reclus's The Earth; Peschel's Physische Erdkunde; Berghaus's Physical Atlas; Bartholomew's Physical Atlas; &c.

PHYSICIANS, ROYAL COLLEGE OF (Edinburgh), a body incorporated by royal charter dated the 26th of November, 1681, and empowered to make laws for promoting the art of physic, and to regulate the practice thereof within the city of Edinburgh, town of Leith, and districts of the Canongate, West Port, Pleasance, and Potterrow. No person was to be allowed to practise physic within these limits without a warrant from the college, and all medicines sold within the same limits were made liable to be inspected by the officers of the college, who were empowered to throw out into the street all such as were found bad or unwholesome. A warrant from the college is no longer necessary to a practitioner within the limits of its former jurisdiction; but the body is now represented in the general medical council established by the Medical Act of 1858, and fellows and licentiates of it are entitled, on paying the necessary fees, to be registered as qualified medical practitioners in accordance with the provisions of that act. See MEDICAL ACT.

PHYSICIANS, ROYAL COLLEGE OF, LONDON. This body owes its origin to the exertions of Thomas Linacre, one of the physicians of Henry VIII., who, through the influence of Cardinal Wolsey, obtained in 1518 from that monarch letters patent incorporating himself with certain other physicians named, and all other men of the same faculty in London, as one body.

Various privileges were accorded to them, the chief of which was that of prohibiting any one from practising as a physician in London, or within a circuit of 7 miles round it, unless he had first obtained a license from this corporation. A charter granted four years later confirmed the privileges of the body, except that graduates of Oxford and Cambridge were permitted to practise within the jurisdiction of the college without previously being examined by it. Various charters have been granted to the body subsequently, but since the passing of the Medical Act of 1858, by which any duly qualified practitioner is entitled to practise according to his qualifications in any part of his majesty's dominions, the license of the college is not necessary to those practising in London or within 7 miles round. As at present constituted the corporation consists of a president and fellows (who alone form the governing body) and members. The fellows are a self-electing body, and are elected from the members of four years' standing. The members consist of persons who had been admitted before February, 1859, licentiates of the college; of certain extra-licentiates (that is, persons qualified under the powers formerly belonging to the college to practise anywhere in England except in London or within 7 miles round it); and of persons of at least twenty-five years of age, who do not dispense and supply medicine, who had been engaged in the study of physic for at least five years previous to their admission, and for at least four years at a medical school recognized by the college, and who, after having been duly proposed, have satisfied the college as to their attainments in medical and general science and literature. Members are entitled to the use of the library and museum and to attend all the college lectures. Licentiates of the college do not form part of the corporation. They must be at least twenty-one years of age, and must have studied medicine four years before being allowed to undergo examination. A fellow on being admitted must pay a fee of 30 guineas, exclusive of stamp duty; a member 30 guineas, and a licentiate 15 guineas. The Royal College of Physicians of London is represented by one member in the general medical council established by the Medical Act of 1858, and fellows, licentiates, and extra-licentiates of the body may, in accordance with the provisions of that act, be registered as medical practitioners. The same act empowers any college of physicians to pass a bye-law to the effect that no one of their fellows or members may sue for fees for professional aid or advice; and the Royal College of Physicians of London has taken advantage of this clause to prohibit their fellows from doing so.

PHYSIC NUTS, the name by which the seeds of the *Curcas purgans* (*Jatropha purgans*, Linn.), a shrub belonging to the natural order Euphorbiaceæ, are known, and which they have acquired in virtue of their strong emetic and purgative properties. The shrub from which they are obtained is a native of intertropical countries, principally the East and West Indies. Its height never exceeds 12 or 13 feet, but its stem is more than proportionally thick. Its leaves consist of five acute segments. Its flowers are of a dull yellow colour, and monœcious, the male flowers having from eight to ten stamens and the female flowers three styles, with thick stigmas, and five glands surrounding the ovary, which is three-celled. The emetic and purgative property of the seeds is due to a fixed oil which resides principally in the embryo. This oil is expressed and used in medicine under the name of *Jatropha* oil, for the same purposes as croton oil, although it is less powerful. The name of French or Spanish physic-nuts is given to the seeds of another member of the same genus, the

Ocrocus multifidus, a shrub which grows to the height of about 10 feet, and has a magnificent foliage. Its leaves are large, and palmated with nine lobes, of a dark green colour above, and glaucous beneath. Its flowers are of a bright red colour, and are arranged in cymes. It is a native of the same regions as the former species. The oil expressed from it is called Oil of Pinhoen, and is similar in its properties to Jatropa oil.

PHYSICS (Greek, *phusis* or *physis*, nature), or **NATURAL PHILOSOPHY**, is the study of the phenomena of the material world. The study embraces a larger field of science than that which is commonly implied when 'matter' is spoken of. It is only the naturalist (so we would term a natural philosopher) who has studied in the school of Newton, Faraday, and Kelvin who can conceive the wonderful relations which exist between the material and all other sciences. There is still, however, a wide separation between the science of dead matter and the science of matter under the influence of life, and towards bridging this gulf very little has been done. We use our living thoughts to discuss dead matter; we perceive force by our muscular exertions; but life itself lies outside the pale of our investigations. There is really no logical division between the two sciences, material and mental. It is with the instrument, the human mind, that we study material phenomena; but we use this instrument as a person ignorant of optics may use a telescope or his eyes in viewing objects. Again, subjects which belong more particularly to natural philosophy are often studied to great advantage by the metaphysician, as for instance the subject of optics was studied by Reid, who enunciated his theory of corresponding points on the retina.

The first steps in investigating a phenomenon of nature are the observation and classification of facts, and these form what may be called the natural history stage of the inquiry. Arguing on these results by induction is the natural philosophy stage. The distinction between these two stages, the more elementary or more observational and the more scientific stage, is of considerable importance in all branches of natural science, astronomy, geology, chemistry, and biology. Mental science has corresponding divisions, mental history being the preparatory and mental philosophy the more advanced stage. Astronomy has long emerged from its natural history stage. Among the Chaldean shepherds, who might notice celestial objects as they noticed plants and animals, we can imagine astronomy to have been classed with other natural history sciences. Now, thanks to long-continued observation and reasoning, we feel on looking at celestial objects that they are bodies we know about, and in our very thoughts astronomy has emerged from the natural history stage. And yet for further progress we still employ natural history methods. With the aid of the spectroscope we can observe phenomena which we cannot explain; for instance, we learn that some stars give different lights when viewed from different quarters, a fact inexplicable at present.

In the first study of minerals we are concerned as to whether they are mere crystals or the remains of plants and animals. When we find a bone or a leaf it is admitted that there has been an animal whose bone or a plant whose leaf has been found. Fossils evidently indicate the previous existence of living creatures. Palaeontology is the name given to that branch of geology which deals with biology. Some great geologists employ a palaeontologist to help them in special investigations; others, like Agassiz, are great geologists and palaeontologists at the same time. The geologist must also consult the chemist as to the

compositions of minerals. The dynamic branch of geology, dealing with the forces which have given its present shape to the earth's crust, has hitherto perhaps been prosecuted rather rashly; yet no other branch of natural science has been of so much use in opening our minds to our position on this globe. Dynamics answers such questions as 'How rigid must the earth's crust be, supposing the interior parts to be liquid, to withstand the decomposing actions of the sun and moon?' The tides exhibit very visibly the yielding of the waters on the earth, and it is proved by dynamics that unless the earth's crust were preternaturally rigid there would be no visible water-tides, because of the yielding of the crust itself. We see, however, that the crust does not yield sensibly, and we are compelled to believe that the earth's crust is not thin. In fact dynamics shows that the earth contains comparatively little fluid matter, and that it is on the whole much more rigid than glass or iron.

Every part of natural philosophy is connected with dynamics, the science of force; and the greater our knowledge of a subject the more we employ dynamical methods of investigation. In combustion we have forces of attraction of particles, and the phenomena of chemistry are every day becoming more and more comparable with the ordinary dynamics of falling bodies. Magnetism shows itself by forces of attraction and repulsion. We cannot yet explain the phenomenon. We see that a certain wonderful property may be communicated to a piece of steel; this property is an external dynamic phenomenon produced by internal dynamics which we do not see, just as external phenomena are produced by the internal invisible mechanism of a clock. We know that magnetism is a certain motion, and that there is a certain 'alignment' of rotation in the axis of the magnet. Heat too is certainly a mode of motion. Light is a motion of a subtle medium pervading space. There are striking relations existing between light and electromagnetic phenomena.

We find then that every division of natural philosophy is founded on dynamics, the science of forces. The science used to be called mechanics, but Newton confines this term to its strictly literal meaning, the science of machines (it is derived from *méchané*, a contrivance); as force was concerned in machines the term came to be used for the science of force. Lord Kelvin and Prof. Tait have protested against the misuse of the term. The science of dynamics is subdivided into statics and kinetics. Statics relates to forces in equilibrium, kinetics to force and motion. The term kinematics was given by Ampère to the study of motion irrespective of force. It is evident that a problem in statics has a kinematic and kinetic basis. There are divisions of dynamics depending on the condition of the matter whose motions are investigated. Thus, hydrodynamics is the dynamics of water and other fluids, it is subdivided into hydrostatics and hydrokinetics, treating respectively of the equilibrium and motions of fluids. Branches of hydrodynamics are pneumatics, static and kinetic, the science of gases. Acoustics, the science of hearing, is intimately connected with pneumatics, sounds being communicated to the ear by the vibrations of gases. It is also connected with almost every other branch of natural philosophy. It rests on a well-established dynamic basis. The articles treating of physics in this Encyclopædia are numerous and need not here be specially referred to. Thomson and Tait's *Elements of Natural Philosophy*, vol. i., treats of dynamics. Students are also recommended to read Everett's English edition of Deschanel's *Natural Philosophy*, a standard work published by Messrs. Blackie & Son.

PHYSIOCRATIC (or AGRICULTURAL) SYSTEM, in political economy. Francis Quesnoy, physician to Louis XV., had observed the very depressed state of agriculture in France whilst travelling with the king, and ascribed it to the mercantile system introduced under Colbert, which favoured the industry of the cities. Quesnoy published his *Tableau Économique avec son Explication* (1768), and developed his system in his *La Physiocratie, ou Constitution Naturelle du Gouvernement le plus avantageux au Genre Humain* (Paris, 1767), and a whole school, called the *physiocratic*, soon sprung up. It was not, however, until the reign of Louis XVI., under the minister Turgot, that the followers of the system came into office. Their authority again sunk, but in the revolution they had for several years a decided preponderance in the convention. Joseph II. of Austria, and Leopold of Tuscany, his brother, were friendly to the system, but did not allow the perfect freedom of trade which it recommended. The principles of the physiocratic system are—1. The earth is the only source of all national wealth; and only those who use or increase the natural powers operating in the vegetable and animal kingdom, as farmers, fishermen, herdsman, miners, add to the amount of actual wealth. All other labourers, mechanics, manufacturers, merchants, produce nothing which can increase the public wealth; they only change the form of the articles produced by the former classes, and their wages will always be paid by the surplus of raw products, which the farmer saves from his own consumption. The merchant only promotes the exchange of goods. Still less is it in the power of public officers and men in similar employments to increase the elements of wealth. 2. All members of the community, therefore, are divided into productive and unproductive. To the latter class belong scholars, artists, mechanics, merchants, &c., because all of them are to be supported by the productions of the earth, without having assisted directly in producing them. What they save from the wages received from the mass of the natural products, in various forms, contributes, indeed, to national wealth, and they become thereby a useful class of citizens, indirectly increasing wealth. It is only by their means, moreover, that the agriculturist is enabled to devote himself exclusively to the culture of the earth. 3. From this it follows that the unrestricted exercise of all honest occupations is necessary to the wealth of both classes. The system inculcates freedom in regard to foreign commerce, as well as to the mechanic arts, considering it a matter of indifference whether the products of a country are consumed by natives or by foreigners. 4. As according to this system all wealth is derived from the soil, the only subject taxed should be the net produce of the soil. The untenableness of this system, without replying to it in detail, rests chiefly in the misconception of nature and its products. The fire of the steam-engine is as much a productive natural power as that producing grain, and the plough as much a machine as the steam-engine.

PHYSIOGNOMY (Greek *physiognōmonia*, literally, the knowledge of nature), is the name given to the countenance of man, considered as an index of his general character, and also to the science which treats of the means of judging of character from the countenance. Whatever be thought of the possibility of laying down strict rules for such judgments, it is a fact of every day's occurrence that we are, almost without reflection on our part, impressed favourably or unfavourably, in regard to the temper and talents of others, by the expression of their countenances. As the face is that part of animals in which the noblest organs are united, by which they put themselves in contact with the world, and, for various

reasons, shows most of their characteristic traits, it has been made the particular object of study by the physiognomist. Aristotle is the first who is known to have made any attempts in physiognomy. He observed that each animal has a special predominant instinct; as the fox cunning, the wolf ferocity, and so forth, and he thence concluded that men whose features resemble those of certain animals will have similar qualities to those animals. Baptista della Porta, in his work *De humana physiognomia* (1586), revived this theory and carried it out further. The French painter Lebrun, in the next century, executed a series of designs expressing the relation between the human figure and that of animals; and the theory that such a relationship is indicative of human character was also adopted and illustrated by Tischbein, a German painter of the eighteenth century. The physiologist Camper, extending the study of physiognomy, sought new data in a comparison of the heads of different types of the human species, and in attempting to deduce the degree of intelligence belonging to each type from the size of the facial angle. Lavater was the first to develop an elaborate system of physiognomy, the scope of which he enlarged so as to include all the relations between the physical and moral nature of man. (See LAVATER.) A great part of the art of painting and sculpture is founded on physiognomy. As the expression of the face depends very much upon the formation of the fore part of the skull, physiognomy is illustrated by craniology. Among the chief points in physiognomy, Kant, in his anthropology, reckons—1. the general formation of the face, particularly in the profile, which is interesting, both in respect to the physiognomy of individuals and of nations, as Blumenbach's investigations prove; 2. the features of the face; 3. the motions of the face, as far as they have become habitual; also the walk, &c. Kant and others think they can show why physiognomy can never be elevated to a science. It is, however, a subject of great interest, but the student must be on his guard against a general application of the rules which experience seems to have furnished him. This was the reason why Lavater's system lasted but a short time, though he has collected valuable materials. Among the works on physiognomy are Michael Scott's *De procreatione et hominis physiognomia opus* (Paris, 1477); *Dissertation sur les différences réelles que présentent les traits du visage*, by Camper (Utrecht, 1791); *An Attempt to Establish Physiognomy upon Scientific Principles*, by J. Cross (Glasgow, 1817); *Mantegazza's Physiognomy and Expression* (1890); *Stanton's Practical and Scientific Physiognomy* (1890), besides Lavater's works on the subject. See LAVATER.

PHYSIOLOGY. This name is applied in medical and biological science to the department of inquiry which investigates the *functions* of living beings. The name 'science of function' has therefore come to be regarded as synonymous with 'physiology,' and the term 'institutes of medicine' has also been applied to this science, from its affording the knowledge of normal functions necessary for the due appreciation of these functions when abnormal or diseased. The word physiology is derived from the Greek *physis* or *phusis*, nature, and *logos*, science; and in the Aristotelian philosophy it signified, in a wide and general sense, the entire knowledge of natural objects, including thus the modern sciences of natural philosophy or physics, natural history, &c. As limited at the present time, however, the science of physiology has for its aim the elucidation of the actions and processes incidental to and characteristic of the *living* state. In its wide sense, therefore, the living functions of both animals and plants fall to be investigated by physiology, this division of the subject being

comprehended under the terms *comparative physiology* and *animal and vegetable physiology*. When more specially applied to the investigation of the functions in man the appellation *human physiology* is applied to the science.

The importance of physiological inquiry, already alluded to in connection with the observation of diseased conditions, cannot be overrated. The knowledge of healthy functions is absolutely necessary for the perfect understanding of diseased conditions; and the science of *pathology*, dealing with the causes and progress of diseases, may in this way be said to arise from, and to depend upon, physiological inquiry in the first instance. Physiology in itself thus forms a link connecting together the various branches of natural history or biology and those sciences which are more specially included within a medical curriculum.

The progress of physiology has of late years been of an exceptionally rapid kind; and in the earlier history of the science there is much to interest and instruct. The broad science of physiology, as known to and studied by Aristotle and the early naturalists, was the first cultivated department of inquiry relating to living beings. It was first taught and investigated as a part in the systems of 'philosophy' which were so numerous in the classical ages. Pythagoras, Empedocles, Alcmaeon, and other philosophers, amid their discussions on abstruse metaphysical subjects, did not altogether neglect to notice the human body, its structures and functions. And such notice, as the beginnings of physiological science thus obtained, although of a very superficial character, yet serves to show us that, insensibly perhaps, but none the less surely, the study of living structures was deemed an essential part of philosophic systems and modes of thought. About 460 B.C. as to time, and in the person of Hippocrates, the science of physiology received more definite attention, and assumed a certain degree of importance in laying the foundation of the system of medicine of that old Greek worthy. The works of Hippocrates afford undoubted evidence that his observations upon diseased conditions had suggested the desirability of an acquaintance with normal functions and structures. Indeed, his speculations as to the ordinary functions of the human body definitely show that the physiological knowledge of Hippocrates, if crude and in many senses erroneous, was at all events of a comparatively extensive character, considering the few opportunities and means afforded him for making observations. About 428 B.C. we find Plato in his lectures embodying certain ideas relative to the formation of the human body, and to the mode in which its elements and parts were arranged. The speculations of Plato had perhaps a chief reference to the 'soul' or 'anima,' and to its relations with the body; and his knowledge therefore more resembled that included in modern ideas and times under the idea of the science of psychology, or the physiology of mind. Succeeding Plato we find Aristotle, about 384 B.C., making great advances on the physiological knowledge of his predecessors, and combining with that knowledge much information concerning the details of structure also. In Aristotle's *Natural History of Animals* frequent physiological details are interspersed among his accounts of the anatomy of living forms. The Alexandrian school of science, flourishing about 280 B.C. under the Ptolemies, and represented by Erasistratus, Herophilus, and others, obtained greater opportunities for the acquirement of physiological knowledge, through the investigation of the bodies of criminals who had been executed. Erasistratus thus threw much light on the nervous system and its physiology; whilst Herophilus made important observations on the pulse;

and in addition discovered the lacteal or absorbent vessels.

After this period came the 'dark days' of physiological science, and of other branches of knowledge. Galen, living in the second century after Christ, may be said to be the first who awoke the world from its slumbers; and by the brilliancy of his intellect, by his fervour and zeal, by his eloquence and his learning, this distinguished labourer effected a vast advance and improvement in physiological knowledge. Besides numerous researches on the structure and organization of the living body, Galen is noteworthy as the first who introduced the method of interrogating nature by experiment. He thus proved that the phenomenon of muscular movement was elicited through the nerves with which the muscles were supplied, by dividing the nerves and thus paralyzing the muscles. He showed that the arteries did not contain air, as was believed by his predecessors, by exhibiting the living vessels filled with blood. He enlightened his contemporaries as to the functions of the kidneys, and of the bile-duct; and in many other respects largely increased the store of medical knowledge of his day. The systems of thought which succeeded Galen and his times consisted, until about 1543, of absurd speculations and theories, conducive in no respect to the advance of true knowledge and research. Paracelsus then appeared with his alchemy and astrology. Van Helmont explained life and its origin by an intelligent being or *archæus*, which had its seat in the epigastrium; whilst Descartes' doctrines of automata and animal spirits may also exemplify a few of the many speculative systems characteristic of the middle ages.

In 1543 Vesalius the anatomist paved the way towards the more definite scientific epochs of modern times by his investigations into the anatomy and structure of the human frame; a work which ultimately cost him his life, since this shining light of science perished by shipwreck whilst returning from the Holy Land in 1564, whence he had been sent by the Spanish Inquisition in expiation of his alleged offence of dissecting men whilst alive. In 1619 Harvey, the 'father of modern physiology,' discovered the circulation of the blood, this discovery marking a very important and significant epoch in physiological knowledge. In 1622 Asellius described the lacteals and their function; and in 1651 Rudbeck of Sweden noted his observations on the general lymphatic or absorbent system. Of Harvey's further researches in connection with reproduction nothing further beyond mentioning these may be said to show the important advance which had thus been made on the uncertainty and speculations of the older savants. Rudbeck traced the lacteal or lymphatic vessels of the intestines to their termination in the thoracic duct; a labour in which Bartholin and Jolyffe about the same time participated. Malpighi is also to be remembered as an original physiological worker of the same century, and as having chiefly devoted himself to the examination of the intimate or minute structure of many organs and tissues of the body, a labour leading to the better understanding of their physiology and functional uses. To Ruysch, a contemporary of the preceding physiologists, belongs the credit of first injecting vessels with wax, &c., and of so tracing them throughout their more minute ramifications. Boerhaave, dating about the close of the seventeenth and beginning of the eighteenth century, made some few original observations, but did not materially aid the advance of physiological science. On Hoffmann and Stahl as physiologists much the same opinion may be passed; but on Haller, who flourished about the middle of the eighteenth century, a very different judgment must be pro-

nounced. His Elements of Physiology contains much original matter, derived from his own observation and research. Haller experimented and investigated boldly, and to many of his pupils he communicated much of his energetic spirit for investigation. The epithet 'the modern father of physiology', has been applied to Haller as deservedly as that of 'father of medicine' was on Hippocrates of old. The method of modern physiology was profoundly influenced by Johannes Muller, and among other leading physiologists of the early nineteenth century were Marshall Hall and Magendie. The later history of the science includes the names of Flourens; Lotze; Claude Bernard, one of the greatest of all physiologists; Von Baer, distinguished by researches in development; Du Bois-Raymond, founder of electro-physiology; Helmholz; Liebig; &c.

One noteworthy peculiarity of modern physiological research may be briefly referred to in concluding this historical notice. This peculiarity or feature consists in the introduction and extensive use into physiology of the experimental mode of investigation; and of elaborate and delicate instruments and apparatus, by means of which many interesting results have been attained which otherwise would have been wholly lost to science. To mention the sphygmograph, or pulse-recorder of Marey; the galvanometer, for determining the electrical currents of muscle; the ophthalmoscope, much used in investigating the normal and abnormal structure of the eye; and the laryngoscope, for exploring the cavity of the larynx, will be sufficient as showing the delicate and important apparatus now at the command of the physiologist, and through him placed at the service of the physician. With the improvement of that all-important instrumental adjunct to the biologist, the microscope (which see), physiology has made rapid strides in the more exact determination of the structural elements and intimate composition of living textures. So wide, indeed, is the field which microscopical inquiry has opened up to physiologists that a special branch of the science has been constituted, for the study of the minute structure of tissues and organs in their obvious relationship to the functions which these organs perform. Thus the department of *microscopic physiology*, or *histology*, has arisen, and from the research thus prosecuted vast additions have been made to other departments, not only of physiology, but also of other and widely-removed sciences.

Contemporaneously, too, with the above department of physiological inquiry, the science of *physiological chemistry* has been making rapid strides, and the composition of the fluids and tissues of the living body, in their relation to the functions of the organism, are now investigated with great success and with valuable practical results.

The different departments of physiology may be enumerated as comprehending the investigation of the three great functions which every living being performs. These include, firstly, the function of *nutrition*. Under this head (see NUTRITION) we investigate the nature and composition of foods and aliments; the processes of mastication, insalivation, deglutition, and digestion—the latter process of itself involving the consideration of the entire alimentary functions, whereby the food is subjected to the action of the various fluids furnished by the digestive glands, such as the liver, pancreas, &c. From digestion we pass to absorption, or that function whereby the food-products, now digested, are taken up or absorbed by the lymphatic vessels, and poured into the current of the circulation, or blood. This leads us to consider the blood itself, its circulation, its mode of nourishing the tissues; and its return to be purified, loaded with tissue-waste, in the breathing organs.

Respiration and the composition of air next engage our attention, and under this head we investigate the process of blood-purification, together with the important subject of the elimination from the system by the skin, kidneys, lungs, &c., of the products of the tissue-waste. Every function whereby the nutrition of the organism is effected, maintained, and subserved, in short, falls to be investigated under this first head.

The second function is that of *correlation*, also called *innervation*. Under this head the functions of the *nervous system* are investigated and determined, these functions being the media through which, as it were, the organism is brought into relation with the world in which it lives, and through which it reacts upon the world. The last function is that of *reproduction*, under which are comprehended the generative acts which result in the production of a new being, and which thus repair the losses death or disease make in the species at large. The phenomena of *development*, or the changes evinced during the progress of the being from its young or embryonic to its mature or adult state, are also included in the study of the reproductive function.

Every living being therefore, viewed physiologically, nourishes itself, reproduces its species, and possesses or appreciates through its nervous system certain relations with surrounding media. The mode in which it thus, through these three great functions, maintains its normal existence forms the study of the physiologist. And coincident with this study we may also find certain points bearing a general relation to these more special departments of inquiry. The primary question which thus meets the physiologist is connected with the investigation of the nature of *life* and *vital phenomena*; and he has thus first to determine if possible the nature of the vital principle, and thence proceeds to deal with its more obvious manifestations. In short, physiology deals with the living being in all its active functional aspects, beginning with its life, proceeding next to investigate its living mechanism, and finally tracing its growth through the earlier stages of development onwards to maturity, decline, and death.

The various physiological processes, functions, and special subjects relating to this science are treated of in detail under their respective headings, such as ALIMENT, DIGESTION, RESPIRATION, GENERATION, SKIN, TONGUE, EYE, EAR, LARYNX, &c.

PHYTOLOGY (from Greek *phuton* or *phyton*, a plant, and *logos*, science), a word sometimes used for *botany*, especially in Germany. See BOTANY.

PIACENZA (anciently *Placentia*, French *Plaisance*), a town in Italy, capital of the province of the same name, in a large and fertile plain, nearly equidistant from Parma and Milan, near the confluence of the Trebbia with the Po, and on the right bank of the latter river. From its situation it is naturally a place of strategic importance, as has been recognized from the earliest times, and it is still surrounded by walls and bastions as well as by detached forts. It has some spacious, but a far larger number of narrow, gloomy, and deserted-looking streets. The principal edifices are the cathedral and other churches. The cathedral was mostly built between 1122 and 1233, but has some additions belonging to the fifteenth century. Some of the churches, particularly that of the Maria di Campagna, ascribed to Bramante, and having a noble dome, are very beautiful and rich in paintings. The town-house (Palazzo del Comune), of the thirteenth century, is one of the finest structures of its kind; the Palazzo Farnese, erected during the reign of Margaret in 1558, is one of the first great works of Vignola. The manufactures consist of various descriptions of cotton goods,

woollens, stockings, hats, leather, &c., and there are also several silk-spinning and paper mills. It is the see of a bishop and the seat of a supreme court of appeal. Piacenza was originally a Roman colony, and was founded along with Cremona in 219 B.C. It became an independent republic in 1126. It lost its liberty in 1254, passed under the hands of various masters, among others the Sforzeschi, under whom it followed the fortunes of Milan. After the battle of Ravenna in 1512 it became subject to the popes, one of whom, Paul III., bestowed it in 1545, along with Parma, on his son Pierluigi. Its subsequent history is identified with that of Parma. The battle of Trebia, in which Hannibal defeated Sempronius, was fought near this town. Among distinguished natives are Lucius Calpurnius Piso, father-in-law of Julius Cæsar, Pope Gregory X., Alessandro Farnese, and Pietro Pallastrelli, a celebrated navigator, and father-in-law of Columbus. Pop. in 1901, 36,064.

PIA MATER. One of the membranes investing the brain. See **MENINGES**.

PIANA DEI GRECI, a town in Sicily, in the province of Palermo and 10 miles S.S.W. of the city of Palermo. It was founded by a colony of Albanese, who took refuge here, in the fifteenth century, in the time of the Ottoman sultan Mahomet II., and the inhabitants still retain certain Albanese peculiarities. Pop. 9000.

PIANO (Italian), soft, low; used in music in contradistinction to *forte*. *Pianissimo*, the superlative of *piano*. The symbols for these terms are *p*. and *pp*.

PIANO-FORTE, or **PIANO**, a musical stringed instrument, the strings of which are extended over bridges rising on the sounding-board, and are made to vibrate by means of small felted hammers, which are put in motion by keys, and where a continued sound is not intended to be produced have their sound deadened immediately after the touch of the keys by means of leathern dampers. Its name is compounded of two Italian words signifying soft and strong, and it was so called in contradistinction to the harpsichord, the instrument which it superseded, and which did not permit of the strength of the notes being increased and diminished at will. The mechanism by which the movement of the keys is conveyed to the strings is called the *action*, and there is no part of the piano-forte in which the variations are more numerous. The principal improvements which have been effected in this mechanism consist in contrivances for enabling the performer to strike the keys with as much or as little force as he pleases, for enabling him to repeat when necessary the same note after the shortest possible interval of time, and for preventing a rubbing contact of the hammer with the string, and thus securing a clearer sound. There are usually three strings in the piano-forte for each tone in the higher and middle octaves, two in the lower, and one in the lowest notes. The strings are of steel wire. The lowest notes have their strings wound round with a double coil of brass wire, and those next above with a single coil. The bi-chord and tri-chord notes have no such wrapping. A softening or loudening of the tone is produced by means of pedals. (See **PEDAL**.) Piano-fortes are either in the form of the grand piano-forte, in which the strings lie in the direction of the keys, or they are of a square or tabular shape with the strings crossing horizontally the direction of the keys; or they have the strings stretched vertically perpendicular to the keys, which is now the most common form, and constitutes the upright piano. Grand piano-fortes are used as concert instruments, and have the greatest compass and strength. The bijou-grand piano-forte is a smaller instrument than that used for concerts, but has a peculiar arrangement of the strings by which almost

as much power of tone is given to it as to the larger instrument. The strings lie in two layers, the tenor and treble strings in the lower layer, and the bass in the upper layer, which is at a different angle from the lower. This arrangement allows of greater length being given to some of the strings than could be done on any other plan. The common compass of piano-fortes at present is six and seven-eighths or seven octaves. The invention of the piano-forte can scarcely be ascribed to any one man in particular, as it was only by a succession of improvements extending over a considerable time, and introduced by different persons, that it reached anything like completeness. The first satisfactory hammer-action appears to have been invented by an Italian of Padua, named Bartolommeo Cristofali, about 1711. About 1716 a Frenchman named Marius exhibited before the Academy of Sciences of Paris three models of instruments of this kind in which the strings were struck by hammers; and a little later a German organist of Nordhausen, called Schroter, appears to have invented a similar instrument independently, two specimens of which he presented to the Elector of Saxony in 1721. The instrument was not introduced into England till the latter half of the eighteenth century. Among the principal improvers of the piano-forte are Sebastian Erard, the founder of the celebrated firm still in existence; Roller et Blanchet, the French firm which introduced the upright piano; Broadwood, Collard, Hopkinson, Kirkman, Brunsmed, Steinway, Chiverning, Bechstein, Bluthner, and various others.

PIARISTS, fathers of the pious schools (*scholarum piarum*), the members of a religious order, who, in addition to the three usual monastic vows, took also a fourth, namely, to devote themselves to the gratuitous instruction of youth. This order was instituted at Rome, about the end of the sixteenth century, by Joseph Calasanza (St. Joseph Calasanctius, died 1648), a Spanish nobleman, and confirmed by Pope Paul V. in 1617, and again by Gregory XV. in 1621, on each of which occasions its privileges were increased. In 1690 it was rewarded for its useful labours by the most important privileges of the mendicant orders. The Piarists are, like the Jesuits, a secular order, subject to rules. They also resemble the Jesuits in their costume, and in their devotion to the service of the church and to education, and have been the rivals of that order from the time of their institution. They soon spread themselves through the Catholic countries, particularly in the Austrian dominions, and became numerous and powerful, without subjecting themselves to the charge of ambitious views, and without meddling in political matters, as the Jesuits did. A number of schools in Austro-Hungary are still under their direction. In some of the Austrian provinces they have also gymnasia or colleges under their management, and their services in the cause of education have undeniably been great. At present this order numbers about 2000 members, who are distributed over some 200 establishments.

PIASSABA, **PIACABA**, or **PIASSAVA**, a strong vegetable fibre imported from Brazil, and largely used for making brooms. It is chiefly obtained from the *Piassava Palm* (*Attalea funifera*), but also, it is said, from the other kinds of palm, as the *Leopoldinia piassaba*. The fibre proceeds from the decaying leaves, the petioles of which separate at the base into long, coarse, pendulous fringes. It is also called monkey-grass and Para-grass.

PIASTRE, a name adopted by several European languages from the Italian *piatra*, that is 'metal plate', and first applied to a Spanish coin, which, about the middle of the sixteenth century, obtained

almost universal currency, and was frequently imitated. In Spain itself the coin was called *peso duro*, or more usually simply *duro*, and sometimes *peso fuerte*. Its proper value was about 4s. 4d., but its actual value varied considerably. In the states of America which were formerly Spanish colonies the piastre is usually called *peso* or *dollar*. The Italian piastre or *scudo* was originally coined in imitation of the Spanish piastre. Its value was different in different states. The name of piastre is still given by other European nations to the Turkish *gersh* (plural *guruh* or *grush*), which was originally worth about 8s. 6d., but has now declined in value to about 2d. in Turkey and 2½d. in Egypt.

PIATIGORSK, a town of Russia in the Caucasus, in the Terek territory, with celebrated sulphur springs which numbers of persons now visit for their curative properties. Pop. 13,665.

PIATRA, a town of Roumania on the Bistritza, 58 miles south-west of Jassy. It has manufactures of paper, and a trade in cereals, cattle, horses, leather, tobacco, spices, &c. In the neighbourhood grows a wine similar to that of Tokay. Pop. 13,890.

PIAUHI, or PIAUHY, a state or province of Brazil, bounded N. by the Atlantic, E. by Ceará and Pernambuco, S. by Bahia, and W. by Maranhão; area, 116,218 square miles. Its coast-line is not above 10 miles in length, and it contains only one harbour, and that very indifferent, at the eastern mouth of the Parnahiba, which is the only river, and which during almost the whole of its course forms the boundary between this province and Maranhão. Towards its bed the surface has a general slope, and accordingly pours all its drainage into it by numerous tributaries, the most important of which are the Urucuhi, the Gorgues, Piaui, Coninde, an affluent of the Piaui, Poti, and Longa. The climate is extremely warm. During the three hottest months of the year the streams and lakes are often laid completely dry. The surface, from its flatness, is well adapted for cultivation; and the soil, generally composed of alluvium, is of great natural fertility. Where a deficiency of moisture is not experienced, as on the banks of the larger lakes and streams, tobacco, rice, and the sugar-cane are successfully cultivated; and even in those districts which suffer most from drought, the rainy season lasts long enough for the growth of millet, haricot, manioc, and cotton. The province is not so densely wooded as is common within the tropics, many of the extensive plains having only a covering of shrubs or verdure. The various species of palm, however, are tolerably abundant, and no want is felt of timber for building and other ordinary purposes. The rearing of cattle, esteemed the best in Brazil, constitutes a principal source of wealth to the province. Horses also of an excellent breed are numerous, and furnish an important branch of traffic. The province contains an establishment for technical education, possessing workshops for tailors, shoemakers, tinsmiths, and other trades. The state legislature holds its sittings in Oeiras. Pop. (1890), 267,609.

PIAZZA, in architecture, is a portico, or covered walk, supported by arches. It properly signifies a square, or open place of any shape, in a city, and has derived its architectural meaning from the fact that in warm countries such open places are frequently surrounded by covered walks.

PIAZZA-ARMERINA, a town in the Kingdom of Italy, in Sicily, province of Caltanissetta, and 18 miles N.E. of the town of Caltanissetta. It is the see of a bishop, and the centre of an agricultural district. Pop. of the commune, 18,252.

PIAZZI, GIUSEPPE, an Italian astronomer, born at Ponte, in the Valteline, in 1746; in 1764, entered the order of the Theatines at Milan, and studied at

Milan, Turin, and Rome, under Tiraboschi, Lessor, and Beccaria. In 1770 he was appointed professor of mathematics at the new university in Malta, on the abolition of which he returned to Italy, and in 1780 became professor of the higher mathematics at Palermo. Having induced the viceroy to establish an observatory there, Piazzì went to England and France to purchase the necessary instruments. The observatory was completed in 1789, and is described in Piazzì's *Della Specola astronomica de' Registudj di Palermo* (1792-94). His first observations were published in 1792. He soon after began his catalogue of stars, and dedicated the first, containing 6784 stars, to the Institute at Paris. January 1, 1801, Piazzì discovered the planet Ceres, in commemoration of which the King of Naples wished to strike a gold medal in his honour; but Piazzì preferred that the money should be applied to the purchase of instruments for the observatory. In 1814 he completed his second catalogue, containing 7646 stars. He had also been occupied in the reformation of the system of weights and measures in Sicily. The observation of comets he always considered as useless. In 1817 the king called him to Naples to examine the plan of the new observatory there. He was then appointed director-general of the observatories of Naples and Palermo. His last years were chiefly devoted to the subject of public education in Sicily. He died July 22, 1826. His *Lezioni elementari di Astronomia*, his most important work after the catalogue of stars, was published at Palermo in 1817.

PIB-CORN. See HORNPIPE.

PIBROCH, a martial air played on the bagpipe by the Scottish Highlanders. Such airs are of a wild and irregular character, and upon Highlanders have always a stirring, often an almost magical, effect. Every clan had its own pibroch.

PICA, a size of type. See PRINTING.

PICARD, JEAN, a French astronomer, born in 1620 at La Flèche, in the department of the Sarthe; died at Paris in 1682. He was of very humble parentage, and appears to have commenced life as a gardener; but having naturally a strong inclination for astronomy, availed himself of an opportunity with which an astronomer furnished him of becoming acquainted with astronomical instruments, and with such success that he ultimately became one of the best observers of his time. He took priest's orders, and officiated for some time at Rille, in his native department; but he first became known to the public in 1645, when he assisted Gassendi in observing the solar eclipse which took place in August in that year. In 1655 he became Gassendi's successor in the chair of astronomy in the Royal College of France. In 1666, when the Academy of Sciences originated, he was one of the eight persons selected by Colbert for the first members. The measurement of an arc of the meridian is the work by which Picard is now chiefly known. His arc, the measurement of which he commenced in 1669, extended between Amiens and Malvoisine. The result gave 57,060 toises for the length of the degree in that latitude, which has since been found to be only 14 toises too little. This measurement is historically important in the science of astronomy, as it furnished Newton with the means of verifying his theory of gravitation, for want of which verification he had not ventured previously to make it known.

PICARD, LOUIS BENOÎT, a French writer of comedies, born at Paris in 1769; died in 1823. Before he was quite eighteen he became an actor, making his debut at the Théâtre Louvois. Almost as early he began to write for the stage with success. About 1800 he became the manager of the theatre, continuing to perform and write at the same time.

He soon after (1806) withdrew from the boards, was admitted to the French Academy, and intrusted by government with the direction of the opera. While at the head of the opera he ceased writing, but in 1816 resumed the direction of the Théâtre Louvois, which had in the meantime been transferred to the Odéon, and again began to write. He died in 1828. Picard, on account of his skillful delineation of character, was called by the French *Le petit Molière*. He was the author of more than seventy larger and smaller pieces, besides several romances. In many of the smaller pieces he employed *collaborateurs*. His works were published in ten vols. at Paris in 1821-22.

PICARDS. See ADAMITES.

PICARDY, formerly a province of France, in the northern part of the kingdom, lying on the British Channel, to the north-east of Normandy, and south of Artois. (See FRANCE.) It was for some time in possession of the British crown. The patois of Picardy is one of three principal dialects of the *langue d'oïl*.

PICCINI, NICCOLÒ, an Italian musical composer, born at Bari, in the Kingdom of Naples, in 1728; died at Passy, in France, in 1800. He was designed by his father, who was a musician, for the church, but soon displayed such a decided taste for music that he was placed at the Conservatory of Santo Onofrio, at the head of which was the celebrated Leo. After spending twelve years there, he left the conservatory, thoroughly grounded in the science of music, and animated with a glowing imagination, which wanted only an opportunity to show itself. He now began to compose comic and serious operas, chiefly for the stages of Rome and Naples, with such success that for many years he was without a rival in Italy. At last, in 1773, a coterie of enemies succeeded in causing one of his operas to fail at Rome, and in raising Anfossi to the place in popular favour which Piccini lost, and this so mortified the latter that he fell sick, and after his recovery determined to devote himself solely to the theatres in Naples. In 1776 he accepted an invitation, on very favourable terms, from the French court, and went to Paris. At that time, besides numerous oratorios, cantatas, &c., he had composed 133 operas. Being entirely ignorant of the French language, he received instruction from Marmontel, and with his assistance brought out the *Roland* of Quinault, which, notwithstanding the opposition of Gluck and his friends, was successful. Although Gluck and Piccini were personally reconciled, yet the war between their respective admirers continued (see GLUCK); and in order to compare their merits, the two rivals composed the same subject, *Iphigenia in Tauris*: in this contest Gluck had the advantage. He was appointed director of the Royal Singing School in 1782, but the revolution deprived him of his appointments, and he returned to Naples in 1791, where the king granted him a pension, and employed him on various occasions; but having become suspected of revolutionary sympathies he was exposed to much hard treatment, and finally returned to France in 1798.

PICCOLO (Italian, *little*), a small flute having the same compass as the ordinary flute, but pitched an octave higher.

PICCOLOMINI, a distinguished Siennese family, still flourishing in Italy in two branches. The two most celebrated members are:—1. **ÆNEAS SYLVIVS BARTHOLOMÆUS**, afterwards Pope Pius II. (See PIUS II.).—2. **OCTAVIO**, a grand-nephew of the first, born in 1599; died in Vienna in 1656. He early entered the Spanish service, but afterwards served in the armies of the German emperor, and became one of the distinguished generals in the Thirty Years'

war. He was a favourite of Wallenstein, who intrusted him with a knowledge of his projects, when he purposed to attack the emperor. In spite of this he made himself the chief instrument of Wallenstein's overthrow, and after the latter's assassination (1634) was rewarded with a portion of his estates. After the battle of Nördlingen (September 7, 1634), in which the Swedes were greatly weakened, he advanced with Isolani through Würtemberg, over the Main. In the following year he was sent to aid the king of Spain against the French, and delivered the Netherlands from the hands of the latter. He was less successful against the Dutch. His further successful campaigns in the Thirty Years' war induced Philip IV. of Spain to beg the emperor to allow him to lead the Spanish armies. The request was granted, and as a Spanish general Piccolomini again distinguished himself in the Netherlands, against both the French and the Dutch. The King of Spain rewarded him for his services, by bestowing on him the Duchy of Amalfi. During the victorious advance of the Swedes in 1648 he was recalled by the emperor, and was appointed, with the title of field-marshal, to the command of the troops destined to oppose them. His military career was concluded after a short campaign in the same year by the Peace of Westphalia. He is one of the principal characters in Schiller's drama of Wallenstein, to the second part of which he gives the title. His son Max, who appears in the same play, is an invention of the poet's.

PICHEGRU, CHARLES, a French general, born at Arbois, in the department of Jura, in 1761. He had a good education, and was for some time a tutor at the College of Brienne, but soon exchanged this profession for that of a soldier. He was stationed at Besançon at the time of the outbreak of the French Revolution, and having placed himself at the head of the revolutionary movement in that town, was chosen the commander of a body of volunteers who went to join the army of the Rhine. In 1792 he held the rank of staff-major in that army, and was rapidly advanced to those of general of brigade and general of division, and in October, 1798, was appointed general-in-chief of the same army. Being unable with his inexperienced and undisciplined troops to meet the well-drilled forces of the enemy in the open field, he carried on the war by repeated skirmishes and partial attacks, and in this way gained such successes that in 1794 he was selected as the fittest man to command the army of the north, then beaten and demoralized. In his new command he showed not less capacity than he had done in his first. He defeated the enemy at Courtray, Menin, Hoogeleds, reduced to subjection Bruges, Ghent, Antwerp, Hertogenbosch, Venloo, and Nijmegen, crossed the Maas and the Waal on the ice in the winter of 1794-95, subjugated Holland, and entered Amsterdam in January, 1795. Pichegru now returned to Paris to enjoy his triumph. He was now at the height of his fame, and was honoured by the Convention with the title of saviour of his country. The Jacobine insurrection of the 12th of Germinal (April 1, 1795) happening to break out when he was in Paris, he was ordered to suppress it. Soon after he set out to take the command of the army of the Rhine and Moselle, but in this post displayed none of his former energy. He had become disgusted by what he had seen at Paris with the anarchical state of affairs then prevailing in the capital, and allowed himself to be won over by the promises of Prince Condé to declare himself willing to bring back the Bourbons. The directory having obtained knowledge of his negotiations with Prince Condé, deposed him (1796), but being too weak to call him to account

for his conduct, offered him the post of ambassador to Sweden. Pichegru refused the offer and retired into private life. Having secured his election to the Council of Five Hundred he was chosen its president (March, 1797), and became the soul of the party hostile to the revolution. Having been proscribed in consequence of the events of the eighteenth Fructidor (September 4, 1791), he was transported to Cayenne, but managed to make his escape the year following. He repaired first to London, and thence to Germany, where he laboured for the ruin of the republic. In 1803 he was again in London, and then he allied himself with George Cadoudal, with whom he entered into a conspiracy to assassinate Napoleon. Having gone to Paris for the purpose, he was captured by the police, and committed to the Temple prison, where he was found strangled on the 6th of April, 1804.

PICHLER, KAROLINE, a German authoress, born at Vienna, September 7, 1769; died there July 9, 1843. Her maiden name was Karoline von Greiner. She appeared in literature as a poetess, dramatist, and novelist, but is only celebrated as a novelist. Her first novel, *Olivier*, was published anonymously in the *Oesterreichisches Taschenkalender* in 1802. Lenore followed in 1804, and *Agathokles* in 1808. Having been recommended to popularize the history of her country, she in 1811 inaugurated a series of historical novels by the publication of the *Graf von Hohenberg*. The chief of the remainder of the series are *Die Belagerung Wiens von 1683*; *Die Schweden in Prag*; *Die Wiedereroberung von Ofen*, *Henriette von England*, and *Friedrich der Streithare*. An edition of her collective works, embracing sixty volumes, was published at Vienna between 1820 and 1845.

PICK-AXE, an axe composed of a wooden handle and an iron head, which has two slightly curved prongs, one on each side of the handle, and forming together one piece. The pick-axe is employed in loosening the soil, in picking out pavement, &c.

PICKETS, in military affairs, sharp stakes varying in length according to the purpose for which they are used. When used for laying out ground they are about 3 feet long, and sometimes shod with iron; when intended for pinning the fascines of a battery, they are from 3 to 5 feet long. In the artillery pickets 5 or 6 feet long are used to pin the park lines; in the camp they are used about 6 or 8 inches long to fix the tent-cords, or 5 feet long in the cavalry camp to fasten the horses.

PICKLE-HERRING. See HARLEQUIN.

PICKLES, parts of vegetables preserved in vinegar, used to give zest to animal food. They are prepared by first washing the parts in clean water, then soaking for a few days in brine, afterwards drying them with a cloth or draining them, and finally putting them into the vessel in which they are intended to be preserved, and pouring in boiling vinegar until the vessel is quite full. Before the vinegar is poured in a few peppercorns, one or two blades of mace, a little ginger, or some other spice, may be added, or whatever spices are used may be boiled with the vinegar. When the vegetables that are to be pickled are naturally soft the vinegar is sometimes poured in cold. To preserve the colour of vegetables that are naturally green, the best means is to steep vine, cabbage, spinach, or parsley leaves in the vinegar. In many cases this is effected with much less trouble by boiling the vinegar in copper vessels, and thus forming an acetate of copper, or by directly adding that salt, which is green; but this practice is a very injurious one, as the acetate of copper is poisonous.

PICO, one of the Azores, so called from a very high mountain terminating in a peak. It lies to the

south-east of Fayal, from which it is separated by a channel about 8 miles in width. The island is about 25 miles long, and has an average breadth of 10 miles. It is entirely composed of lava, originally so bare that earth had to be brought from Fayal to make a soil. Now the slopes are covered with various objects of cultivation, especially vines, which yield in an average year from 20,000 to 25,000 pipes of wine, which is chiefly exported, by way of Fayal, to the Antilles. The chief town is Villa-di-Laguna. Pop. 27,000. See AZORES.

PICO DELLA MIRANDOLA. See MIRANDOLA.

PICOLINE (C_6H_7N), a base, isomeric with aniline, prepared from coal-naphtha. It is a colourless, mobile liquid, possessing an intensely powerful odour; when inhaled through the nostrils it produces a bitter taste in the mouth and back of the throat. Picoline has an alkaline reaction; it boils at 185° . It forms a well-defined series of salts; and a series of substitution products is derived from this base. Picoline is also produced in the dry distillation of a number of animal and vegetable substances, such as bones, beans, cinchonine, peat, &c.

PICOTEE. See CARNATION.

PICQUET. See PIQUET.

PICRIC ACID ($C_6H_3N_3O_7$). This acid forms light yellow, strongly-shining laminae, which have an exceedingly bitter taste. It is produced in many different ways and from many sources; from phenol (which see), by the action of nitric acid, a reaction which leads to the rational formula $C_6H_2(NO_2)_3OH$, and the name of trinitrophenol, for this body; from indigo also by the action of strong nitric acid; from silk, from aloes, from benzoin, &c. &c. Picric acid is a powerful dye-stuff; it is especially used for dyeing silk of a yellow colour. The colour resists the action of light very well, but is somewhat affected by washing with soap. As cotton, hemp, and flax are not dyed by picric acid, this substance may be used as a test for distinguishing those materials from silk and wool. Picric acid is monobasic, forming a series of *picrates* having the general formula $C_6H_2M(NO_2)_3O$, where M represents a monovalent metal. See LYDDITE in SUPP.

PICROTOXIN ($C_{20}H_{15}O_{13}$), the poisonous principle of the seeds of *Cocculus Indicus* (*Mentispermum Cocculus*). By exhausting the pulverized seeds with alcohol and decolourizing with lead acetate, picrotoxin may be obtained in colourless, needle-shaped crystals, which have an intensely bitter taste. Picrotoxin is tolerably soluble in water; it unites with various metallic oxides, forming uncrystallizable compounds. It is a poisonous substance.

PICTOU, a thriving commercial town in the northern part of Nova Scotia. It is well built, and has a safe and commodious harbour, with a light-house at the south side of its entrance. It is the resort of coasters from all parts of the Gulf of St. Lawrence, the eastern shores of Prince Edward's Island, and the north coast of Cape Breton. The coal-mines in its vicinity are very extensive, and the coal is excellent. Iron is also found and manufactured in small quantities, and there are extensive quarries of building stone. Coal is the chief export. By a branch of the Inter-colonial Railway it has communication with the neighbouring towns and the rest of Canada. Pop. (1901), 3735.

PICTS, the name anciently given to the inhabitants of a large portion of the present Scotland. They are celebrated in Scottish history on account of the controversy which has long been waged as to their ethnological relations, and which is known as the Pictish question. The chief subject of controversy is whether they were a Celtic or a Teutonic

people. The materials on which the controversy is supported are very slender, from which it naturally follows, that, in spite of the great amount of learning and ingenuity that have been employed in it, it has led to equally slender results. It is not even known whether the name of Picti, by which the Romans designated this people, and which vernacular chroniclers of Scandinavian and Saxon origin corrupted into Pecht and Pechtar, was originally a Latinized form of the name which the people gave to themselves, or a descriptive appellation bestowed upon them on account of their habit of painting their body. The name is, at any rate, mentioned by Roman writers as an appropriate one, from which it would appear that they had the custom referred to, whether they got their name for that reason or not. On the supposition that the name is a native one numerous attempts have been made to connect them with some other people bearing a similar name, but none of these attempts has led to any satisfactory conclusion. The most audacious of them is that of Pinkerton, who attempted to identify them with the Peukini, a Scythian, and, as he thence assumed, Teutonic people, originally located about the mouth of the Danube. The name of this people thus failing to afford any trustworthy clue as to their ethnological identity, antiquarians and historians have sought for more light on the subject in the language of the people, in an etymological study of their geographical and biographical names, in the allusions made to them by early writers, and in the character of their remains; but these investigations have scarcely yielded any more information than the first. As to their language all that we know is that they had a language different from the Saxon or English, from the British, and from the Irish, or the language of the Scots of Dalriada, who were settled to the west of the Picts, and sufficiently different from the last-mentioned to make it necessary for the Scot, St. Columba, when preaching the gospel to the Northern Picts to make use of an interpreter, as he is mentioned on two occasions by his biographer Adamnan to have done. Of this language the sole relic that was known for a long time was the single word *Paenfael*, which Bede states to have been the Pictish name of the western termination of the northern Roman wall, called in Saxon *Peneltun*; yet notwithstanding this that single word has been made the ground of many learned discussions, bearing a tolerably close resemblance to that between Monkbarns and Sir Arthur Wardour in Sir Walter Scott's *Antiquary*, where the former deduces from it a Gothic, and the latter a Celtic origin for the Picts. A few more Pictish words and syllables have since been brought to light through the labours of Dr. Skene, but little more has been gleaned from them than from the single word previously known. The attempts to draw any well-grounded inferences from the allusions to the Picts in ancient writers, and from the etymological study of the geographical names which were given, or may have been given, to the rivers, lakes, mountains, and localities in the region inhabited by them, or of the names contained in the lists of Pictish kings, have been equally fruitless; and the same has hitherto been the case with the ancient remains attributed to the Picts. It is thus apparent that there are not the means for definitively deciding the question either one way or the other; but the preponderance of opinion seems to be on the side of the belief that the Picts were Celts by language (though they may have been partly Iberians by race), a conclusion which is favoured by the ease with which the Picts and Scots amalgamated into one after they were united under one king, in the middle of the ninth century.

The history of the Picts is wrapped in nearly,

though not quite, as much obscurity as their ethnological character. One of the main causes of this obscurity is the irreconcilable differences between the various early Scotch chronicles, and it has now been shown that these differences arise to a large extent from wilful fabrication. In his recent publications, noticed at the end of this article, Dr. Skene has shown the motives and traced the history of the fictitious chronicles. The result of his researches is that the fabrications took place at the time of the disputes between England and Scotland as to the claim of the former to ecclesiastical and feudal supremacy over the latter. When the claim to ecclesiastical supremacy was that which was chiefly to be resisted, the Scotch chronicles are framed so as to support the ecclesiastical independence of the see of St. Andrews, which is done by throwing its foundation back from the eighth to the fourth century, and thus to a date antecedent to the foundation of the see of York, and altering the chronicles of the Scottish kings (which were already crowded with unconscious myths) so as to harmonize with this change. When, on the other hand, the main object of the fabrication was to maintain the Scottish claim to civil independence, the chronicles were framed so as to show the superior antiquity of the Scottish kingdom as compared with that of England, and this was done by placing the whole list of the Scottish kings of Dalriada, in Argyle, before the lists of Pictish kings, which made the Kingdom of Scotland date from 443 B.C. Finally, towards the close of the fourteenth century, Fordun appeared with a new chronicle, the main feature of which Dr. Skene has shown to be an attempt to weave the two sets of chronicles already existing into one.

The first mention that is known to have been made of the Picts occurs in a speech delivered in the year 296 A.D. by one Eumenius, on the occasion of the victory of Constantius Chlorus, afterwards emperor, over Allectus. They are again mentioned by Ammianus Marcellinus, in 360 A.D., along with the Scots, as laying waste the parts of the Roman province adjacent to their territory, and the earliest British chroniclers frequently speak of the Picts and their country Pictavia or Pictland. The region occupied by them appears to have embraced the whole of Scotland to the north of the Forth and Clyde, except the county of Argyle, where some isolated bands of Scots from Dalriada, in the north-east of Ireland, established themselves as early as the fourth century, and where they set up a separate kingdom in the beginning of the sixth. The earliest important historical fact connected with the Picts is the introduction of Christianity among them by the preaching of St. Ninian in the beginning of the fifth century, and by this time they were divided into two kingdoms, that of the Southern Picts to the south of the Grampians, having its capital at Forteviot, in Strathearn; and that of the Northern Picts, called by the Irish chroniclers Cruithne or Cruithnach, to the north of those mountains, having its capital at Craig Phadrick, and it was to the former of these that St. Ninian confined his labours. The kingdom of the Northern Picts did not receive Christianity till about the close of the sixth century, when it was introduced by St. Columba. This is almost the sole fact that has come down to us regarding the Northern Picts, although there is sufficient evidence to show that they continued to have a separate existence long after this, a thing which is at any rate probable enough, from the nature of the barrier which divided the two kingdoms. Somewhat more is known concerning the Southern Picts. In the seventh century their history is closely connected with that of Northumbria, the kingdom conterminous with theirs on the south. In

617 Edwin of Deira, the first Christian king of Northumbria, having slain Ethelfrid, the previous king, and driven his sons from the kingdom, these took refuge with the Picts, and one of them, Eanfrid, married a Southern Pictish princess. Their son Tolargan succeeded to the throne, and reigned till 657 or 658. Meanwhile the brothers of Eanfrid had recovered the throne of Northumbria, and one of them, Oswy, who happened to be king at the time of the death of Tolargan, shortly after that event, and probably taking advantage of some pretext which the relationship between the two afforded, invaded the Kingdom of the Southern Picts, and succeeded in establishing Northumbrian rule there. This Northumbrian supremacy lasted till 685, when Egfrid, who had meantime succeeded Oswy, attempted to push his conquests still further, and crossed the Tay with an army apparently pretty numerous. He had proceeded as far as Nechtan's-mere or Dunnechtan (identified with Dunnichen in Forfarshire) when he was met by the Picts, and sustained so crushing a defeat that the Picts not only recovered their independence, but even appear to have extended their frontiers for a time as far as the Tweed. The precise date of this event was the 20th of May, 685. During the Northumbrian domination the religious observances of the Anglican Church, which were the same as those of the orthodox church, had been introduced into the Kingdom of the Southern Picts, in place of those of the followers of Columba, which differed from those of the orthodox church, as to the time of keeping Easter and the form of the tonsure, and which at some previous period had been extended from the Northern to the Southern Picts. After the expulsion of the Northumbrians the orthodox practices do not seem to have been altogether abandoned, or if abandoned for a time were restored early in the eighth century. This was done by Nechtan, one of the two best known kings of the Southern Picts. He applied for guidance in this matter to Ceolfrid, abbot of Jarrow, and acted so energetically on his advice as to expel the clergy who proved refractory from his dominions. He also founded a monastery at Abernethy, to take the place of that of Iona as the chief ecclesiastical authority for his kingdom. He reigned for eighteen years, at the end of which time he was defeated by Angus Macfergus, who, after an intermediate period of struggle, succeeded him. Angus was the most powerful of all the Pictish kings. After firmly establishing his sway over all the land of the Southern Picts, he extended it also over the Northern Picts, and finally overran and put an end to the kingdom of the Scots in Argyle (741), thus bringing for the first time the whole of Scotland to the north of the Forth and Clyde under one rule. He reigned for twenty years after this last conquest, dying in 761. After this the Picts disappear from history for the greater part of a century, and when they reappear they do so as forming part of a kingdom co-extensive with that of Angus, but ruled over by a Dalriad Scot, Kenneth Macalpin (843). It is not improbable that this monarch had hereditary claims to the throne that had previously belonged to the Picts. He is called the grandson of Aucha or Eocha, and it is said that this Aucha had married a Pictish princess named Ergusia, through whom Kenneth Macalpin inherited his title. A powerful current of tradition makes it not unlikely, however, that whether this king had any hereditary claim to the Pictish throne or not, he had to make good his position by force of arms. Many historians have contended, on the strength of the later chronicles, that the change of the royal house at this time was due to the complete conquest and almost the annihilation of the Picts by the Dalriad Scots; but an examina-

tion of older and more trustworthy documents has shown that this supposition must be abandoned, that the two peoples had been gradually prepared for union before it actually took place, that after Kenneth had established himself firmly on the throne, whether peacefully or by force, they lived together not as a subject and a conquering people, and that while the names of Picts and Pictland continued to be used more or less as general designations for the people and the country of the north of Scotland for more than a century after Kenneth's accession, those of Scots and Scotia do not come to be used in the same way till about two centuries after that event.

The most important works throwing light on the history of the Picts and the Pictish question, are the *Life of St. Ninian*, by Ailred of Rievaulx, in Pinkerton's *Ancient Lives of Scottish Saints*; Adamnan's *Life of St. Columba* (edited by Dr. Reeves); O'Connor's editions of the *Irish Annals* (the most trustworthy early chronicles); Dr. Skene's *Chronicles of the Picts, Chronicles of the Scots*, and other early memorials of Scottish history, with a preface treating of the relations between the Picts and Scots (1867); the same editor's *Four Ancient Books of Wales*, with a preface which, among other matters, discusses the place of the Picts among the native races of Britain (1868); Fordun's *Scotichronicon*, edited and translated from the *Wolfenbuttel MS.* by the same scholar (1871-72); *Celtic Scotland*, by the same author (in 3 vols. 1876-81); Father Innes's *Critical Essay on the Ancient Inhabitants of the Northern Part of Britain* (1729); Pinkerton's *Inquiry into the History of Scotland* (1789); Ritson's *Annals of the Caledonians, Picts, and Scots* (1828); E. W. Robertson's *Scotland under her Early Kings* (1862); *Sculptured Stones of Scotland*, edited for the Spalding Club by Dr. John Stuart (1856-67); and Rhys's *Celtic Britain* (1884).

PICTS' HOUSES, a name given in Scotland to a kind of ancient underground dwellings otherwise called *earth-houses*. They are generally built in dry sloping ground, such as hill-sides or the banks of rivers, and usually consist of a chamber from 20 to 60 feet long, 4 to 10 wide, and 4 to 7 high, constructed of unhewn stones without cement, roofed with unhewn flags, and entered by a narrow doorway near the top. Stone implements, bones, ashes, &c., are found in them.

PICTURES, COPYRIGHT IN. This is now secured to British artists and other artists resident within the dominions of the crown, by Act 25 and 26 Vict. c. lxxviii. (1862), which not only applies to paintings, but also to drawings and photographs. This act gives to the artist the sole right of copying, reproducing, and multiplying such paintings and drawings, and the designs thereof, or such photographs and the negatives thereof, for the whole of the artist's life, and to his heirs for seven years after his death. When a painting, drawing, or negative of a photograph is first sold or otherwise disposed of after its production, there must be a special agreement stating whether the copyright is retained by the artist, or made over to the purchaser or assignee. The penalty for the violation of such a copyright, is any sum not exceeding £10, and forfeiture of all the copies. A register of proprietors is kept at Stationers' Hall, and no penalty is recoverable unless the picture or other work has been registered.

PICUS, an old soothsayer or wood-deity in Italy, son of Saturn and father of Faunus, was beloved by the sorceress Circe, who changed him into a woodpecker because he would not return her passion. His wife Canens pined away into air from grief. Picus was represented with the head of a woodpecker (Latin, *picus*), and presided over divination.

PIDDOCK. See PHOLAS.

PIEDIMONTE D'ALIFE, a town in Italy, in the province of Terra di Lavoro, 19 miles north of Caserta. It has manufactures of cotton and paper, and there are copper-mines in the neighbourhood. Pop. 7073.

PIEDMONT (Italian, *Piemonte*), a department (*compartimento territoriale*) of Italy, bounded on the north by Switzerland, east by Lombardy and Emilia, south by Liguria, and west by France; area, 11,198 square miles. It derives its name, signifying 'foot of the mountain,' from its situation at the base of the loftiest ranges of the Alps, the Lepontine, and Pennine, which encircle it on the north and north-west; the Graian and Cottian Alps on the west, and the Maritime Alps and Apennines on the south. The space inclosed within these barriers forms one of the most beautiful and fertile portions of Europe, commencing on the north, the south, and the west in majestic mountains, and thence descending by magnificent terraces and finely-undulating slopes to the rich plains of the Po. To the basin of this river, and consequently to that of the Adriatic, all the surface belongs. Besides rising within Piedmont, and winding circuitously across its centre, the Po receives within it (besides numerous minor streams) on the right the Maira, Tanaro, and Scrivia; and on the left the Clusone, Dora-Ripaire, Dora-Baltea, Sesia, and Ticino, which last forms the eastern boundary of the province from the point where it issues from the Lago Maggiore to its junction with the Po. Few of these are of navigable importance; but from the extensive and skilful use made of them for purposes of irrigation, it is almost impossible to overrate the advantages derived from them. In every quarter they are seen acting as an essential agent in the production of most luxuriant crops of wheat, maize, rice, beans, hemp, and hay. In all of these Piedmont after fully satisfying its own wants has a large surplus for export. Wine also is abundantly grown, and vast numbers of cattle are reared both for fattening and the dairy. There is no region of Italy in which silkworms are more extensively reared. The value of the silk which is obtained from them, and which is mostly exported in the raw state, is estimated at about £1,000,000 annually. The most valuable minerals are iron and marble, but there are also mines of argentiferous lead and of copper. The manufactures consist of silk, woollen, cotton, and flax tissues, and there are great numbers of silk-mills. The exports are chiefly grain, cattle, silk, hides, wine, wool, and iron. The great body of the inhabitants profess the Roman Catholic religion; but the mountain districts have from time immemorial contained great numbers of Waldensians, attached to a purer faith, and well known throughout Europe for the cruel bigotry with which they have been hunted, and the heroic patience with which they have endured. Piedmont is divided into four provinces—Turin, Alessandria, Cuneo, and Novara. The chief town is Turin, which from 1860 to 1865 was the capital of the Kingdom of Italy. Pop. on the 31st of December, 1890, 3,234,506.

Piedmont corresponds to the western part of the Gallia Transpadana and the northern part of the Liguria of the Romans. The Salassi, who inhabited the north-western part of this district, were a very warlike people, and were frequently in conflict with the Romans. They were not finally subdued till the time of Augustus, when most of the inhabitants were killed in battle, and the remainder (about 36,000) carried off as slaves. Their chief town was then colonized by Roman soldiers of the prætorian guards, and received the name of Augusta Prætoria (Aosta). The tribe living between the Salassi and the Ligurians was the Taurini, and their chief town in the reign of Augustus was called Augusta Taurinorum

(Turin). After the fall of the Roman Empire Piedmont passed into the hands of the Goths, and then into those of the Lombards, from whom it was taken by Charlemagne. On the establishment of the feudal system it was possessed at first by the Marquises of Susa, Ivrea, Montferrat, and Saluzzi. In 1042 it passed to the counts of Maurienne, of the house of Savoy, with which it has since remained. In 1424 it was erected into a principality, and in 1718 became a part of the Kingdom of Sardinia, which was formed in the reign of Victor-Amadeo II. Since that date it has shared the fortunes of that kingdom. See **SARDINIA**, **SAVOY**, and **ITALY**.

PIENO (Italian, full), in music, a word often used for *tutti*, *grande*, or *grossi*, to signify that all the instruments of an orchestra are to be employed; and sometimes with *coro*, as *pieno coro* (a full chorus).

PIEPOWDER COURT, or **PIEPOUDRE COURT**, a court formerly set up at fairs and markets in England for the summary administration of justice in cases arising there. It is also called the Court of Dusty Foot, which has the same meaning as piepowder (a corruption of the French *piéd poudreux*), and probably got its name from the fact of its being chiefly resorted to by pedlars and wayfaring persons, to whom the name of *pieds puidreaux* was given in Old French.

PIERIAN, an epithet given to the Muses, from Mount Pierus in Thessaly, which was sacred to them, or from their victory over the nine daughters of the Macedonian king Pierus, who were changed into magpies for having dared to engage in a contest with them. Pierides was also one of the designations of the Muses, for the same reasons.

PIERRE, **JACQUES HENRI BERNARDIN DE SAINT**, a miscellaneous French writer, born at Havre in 1737; died on his estate at Eragny-sur-Oise, Jan. 21, 1814. In his twelfth year he sailed with his uncle to the Island of Martinique. After his return he entered in 1757 the school of engineers (*école des ponts et chaussées*) at Paris. In 1760 he was sent as an engineer officer to Düsseldorf, but was dismissed for insubordination. He then went to Malta to receive an appointment which he had been promised as engineer to the Maltese knights, but soon returned to France. After remaining for a certain period in Paris, giving private instruction in mathematics, he went to Amsterdam, where he gained a living as a journalist. We next find him in the service of Catharine II. of Russia, where he remained eighteen months. He then joined the French party in Poland, was made prisoner by the Russians, released, and after residing in Warsaw, Dresden, Berlin, and Vienna, returned to Paris. He obtained a commission in the engineer corps stationed in the Isle de France, but in two years threw up his commission on account of some disputes in which he became involved, and returned to France. Here begins his literary career, for which his changeful life had furnished him with rich materials. His first publication was the *Voyage à l'Isle de France*, which appeared in 1773. In 1784 appeared his *Études de la Nature*, in five volumes. Louis XVI. now appointed him superintendent of the botanical garden and of the Museum of Natural History. His Paul et Virginie (1789) passed through fifty impressions in one year, and has been translated into almost all the languages of Europe (English by Helen Maria Williams). Napoleon conferred on him the order of the Legion of Honour, and Joseph Bonaparte granted him a pension of 6000 francs. St. Pierre was also the author of *La Chaumière Indienne*, *Harmonies de la Nature*, and several other works. The best edition of his whole works is that published at Paris in 1818–20, which has been several times reprinted.

The editor of this edition was Aimé Martin, who also wrote an *Essay on the Life and Writings of Bernardin de St. Pierre*. See also the *Correspondance* (1829) by the same editor, and works by Barin (1891), Lescure (1891), and Maury (1892).

PIERRE, St., a small island belonging to France, near the south coast of Newfoundland, south-east of Miquelon, with which it forms one colony, under a governor residing in St. Pierre. The inhabitants subsist entirely by the cod-fisheries and the industries connected with them. The surface of the island is bare and rugged, and there is hardly any agriculture. The exports of the colony consist in the products of the fisheries, and the imports of articles of food and manufactured goods from France. The two islands were first acquired by the French in 1763; and after being several times taken by the English and restored, were confirmed to France in 1814. Pop. of St. Pierre, 5700.

PIERRE, St., a French seaport town in the West Indies, in the island of Martinique, on the north-west coast. It is built upon a narrow strip of low land, and runs parallel to the beach of a circular bay. Mount Pelée, a lofty volcanic mountain, rises behind, and Saint Pierre was a well-built, flourishing, and attractive place, when in May, 1902, it was destroyed by a sudden eruption of Mount Pelée, with an appalling loss of life. Pop. (1894), 25,382.

PIERROT, on the French stage, one of the characters that appear in pantomime. The pierrot is a cunning and shameless poltroon, whose delight is in mischief or roguery. His dress is white, very wide and loose, with huge buttons.

PIETERMARITZBURG, or simply **MARITZBURG**, the capital of the colony of Natal, is situated on an elevated plain about 54 miles west-north-west of Durban, on the river Umsindusi, a tributary of the Umgeni. It is a thriving and pleasant town, well laid out, with broad streets often planted with trees. The buildings are mostly of red brick, and the streets are lighted by gas and electricity. It contains several handsome public buildings, including the Legislative Council building, in front of which is a white marble statue of Queen Victoria. The fine town-hall was destroyed by fire in 1898. Pietermaritzburg is the seat of an Anglican bishopric, and among its churches are two cathedrals. The most noteworthy of the other buildings are the governor's residence, the post and telegraph offices, the railway-station, the court-house, the market, the library, a small museum, Maritzburg College and several public schools, an Anglican college for girls, a Roman Catholic convent, the masonic and Y.M.C.A. halls, a public hospital and a private one (the Mitchell Institute), a fine lunatic asylum, a bathing establishment, &c. There is a monument to those who fell in the Zulu war, and another to Sir T. Shepstone (1896). The town has several reserves for recreation purposes, the chief being Alexandra Park. The Botanic Gardens are situated a short distance from the town. The extensive water-works cost about £60,000. Fort Napier contains the barracks. The chief industries are the building of carts and wagons, tanning, and brewing, and there is some trade in hides, &c. Pietermaritzburg stands on the railway from Durban to Pretoria. It was founded by Boers in 1839, and derives its name from two Boer leaders, Pieter Retief and Gert Maritz. Pop. in 1900 (excluding military, &c.), 28,500.

PIETISM, in German theology. The name of *pietists* was originally applied in derision to some young teachers of theology at Leipzig, who began in 1689 to deliver ascetic lectures on the New Testament to the students and citizens. The idea of imparting theological instruction in a regular way

came from their friend and teacher Spener, who had held religious meetings in Frankfort from the year 1670, at which the laity prayed, and were allowed to ask questions, &c. The theology of the Lutherans at that time had become stiff and dogmatical, attacking unsparingly all other systems, and making the essence of theology to consist in doctrines. Spener and his friends were desirous of re-establishing a Christianity of love and charity, which should manifest itself in the life of the individual. The governments, however, in several places soon prohibited such assemblies, which in some cases may in fact have given rise to disorders. Pietism, however, did not expire. While on the one hand the Leipzig lectures were put a stop to as being hostile to good government, there was on the other hand a new university, that of Halle, founded (1695) under the influence of Spener and the pietists. The leading adherents of Spener were appointed its first professors, among them Francke, the founder of the celebrated Waisenhaus or orphanage at Halle. An austere, often sombre morality, a belief in a sudden regeneration by the operation of divine grace, private meetings for religious exercises, &c., distinguished the pietists, though they never formed a separate sect. But, like the systems of so many sects, originating from a sincere desire for some better means of quenching a religious thirst than the dogmas of the established church afforded, pietism in many cases degenerated by degrees into an ill-regulated religious excitement. The Jansenism and Quietism of France, and the Methodism of England, sprang from sources similar to those of the German pietism. The name of pietists is still given in Germany to that section of Protestants which inclines to the views of Spener. In the more recent period of religious history in Germany they have been found now in alliance with the orthodox party in opposition to the rationalists; and again holding a separate position, in conflict with both orthodox and rationalistic theologians. See SPENER.

PIETOLE, a village in Italy, on the Mincio, 3 miles S.E. of Mantua, supposed to be on the site of Andes, where Virgil was born. A statue of the poet was erected here in 1884.

PIETRA DURA, a kind of mosaic executed in Italy, and especially at Florence, in hard stones, such as topazes, garnets, carnelians, rubies, &c. Inferior kinds, in which imitation stones are used, are largely made in England (Derbyshire and elsewhere), as well as in Italy. See MOSAIC.

PIETRO DI CORTONA. See CORTONA.

PIG. See HOG.

PIGAFETTA, ANTONIO, the companion of Magellan and the historian of his discoveries, was born at Vicenza about 1491. Inflamed by reading the accounts of the Spanish and Portuguese discoveries, with a desire of visiting distant parts he studied the mathematical sciences and navigation; and when Magellan was sent out by Charles V. to search for a western passage to the Moluccas, Pigafetta obtained leave to accompany him, and thus took part in the first circumnavigation of the globe (1519-22). He kept a journal of the voyage, of which a complete edition was first published under the title *Primo Viaggio intorno al Globo Terracqueo* (Milan, 1800), by Amoretti. There is a later edition by Allegri (1894).

PIGEON, the general name of an order of birds closely related to the gallinaceous species, applied more especially to the family Columbidae. The Pigeons or Doves as a group are distinguished from true Gallinaceous Birds, such as the Fowls, &c., chiefly and primarily by the conformation of the bill. The upper mandible is in them arched towards

its apex, and is of horny consistence, whilst a second curve exists at its base; this latter convexity being formed chiefly by a cartilaginous plate or piece covering the nostrils—which apertures open in its anterior portion. This cartilaginous portion may be invested by a soft skin, which is occasionally provided with a fleshy or warty prominence. The tarsi are short, and are generally covered with scales, but in some cases they may possess a feathery investment. The three front toes are in the majority of cases entirely disconnected; the outermost of these digits being occasionally united to the middle toe near the base. The hinder toe reaches the ground, being situated on the same level with the front digits. The toes are scaly at their upper portions, furnished with membranous lobes beneath, and are provided with short nails of curved shape. The quills of the wings are elongated. They are usually of pointed shape, and number ten in the primary series. The quills of the tail generally number twelve; but sixteen may be present. No accessory plumes are developed on the feathers of the Pigeons. The 'crop' in these birds is of large size, and of double conformation; the so-called 'pigeon's milk' consisting of the mucous secretion of the glands of the crop mixed with the softened food, which, being regurgitated from the crop, is used by the Pigeons to feed their young. The cæca of the intestine are of small size. The gizzard is of strong conformation.

In habits the Pigeons differ from the majority of Rasorial Birds in being arboreal in habits, perching upon trees, and building their nests in elevated situations. Their powers of flight are also greatly in advance of those possessed by Gallinæ as a rule; and they are also capable of running actively on the ground in search of food. The Pigeons also take water by immersing the bill, and by taking a continuous drink; instead of frequently sipping the fluid after the fashion of true Rasores. The young are heterophagous, that is, are entirely dependent upon the parents' care after being hatched. Both sexes incubate; and these birds generally pair for life; the loss or death of a mate being in many cases apparently mourned and grieved over, and the survivor frequently refusing to be consoled by another mate. The song consists of the well-known plaintive cooing. The Pigeons are distributed in every quarter of the globe, but attain the greatest luxuriance of plumage in warm and tropical regions.

The Pigeon family is divided into various groups, exhibiting greater or less variations in plumage and structure. The true Pigeons or Columbids are represented by the Stock Dove (*Columba ænas*) of the southern English counties, which has been credited with being the progenitor of the domestic pigeon. The Ring-dove or Cushat (*C. palumbus*) is the largest British species, and has a wide distribution in Britain, and over Europe generally. It is found in Madeira, North Asia, and Africa. The Turtle Dove (*C. tur-tur*), found in Britain in summer, and the Cape Turtle (*C. Capensis*), are also representative species. The Rock Dove (*C. livia*) forms a third species, from which the various domestic varieties have sprung. The Rock Pigeon is found in the northern parts of the eastern hemisphere. It builds in the holes and crevices of rocks, its food consisting of grains. It is, however, also said to feed on snails, &c. Each of the two broods produced annually includes a pair of young. The House Pigeons, Tumblers, Fantails, Pouters, Carriers, and Jacobins are the chief varieties of the Rock Pigeon, and are well known as forming some of the most elegant of domesticated birds. These birds and their varieties have been employed by Mr. Darwin (see his *Origin of Species* and his *Animals*

under Domestication) to illustrate many of the points involved in his theory of 'descent by natural selection.' The Pouters are so named from their inflated crops; the Fantails from their expanded tail, consisting of no less than thirty-six feathers; the Jacobins from the presence of a ruff or hood of feathers on the neck and head; and the Tumblers, from their habit of tumbling over in the air whilst flying. The Carrier Pigeon (which see) exemplifies a striking development of the 'homing' faculty, possessed by Pigeons generally, through the exercise of which these birds are enabled to return to their native haunts from long distances and with great speed. Before the introduction of the telegraph these birds were—and indeed in some cases still are—employed in conveying intelligence from one town or place to another in cases where despatch and secrecy are required. The Passenger Pigeon of North America is described under the article of that name.

The *Treeronide* or Tree Pigeons of India, the Eastern Archipelago, and Australia, are distinguished by the short stout bill, the mandibles being of nearly equal thickness, and both arched at the top. The inner toes are shorter than the outer digits, and the tarsi are feathered. They inhabit trees and subsist on fruits. The plumage in many forms of this group is brilliantly coloured.

The *Gourida* or Ground Pigeons, inhabiting the tropic regions of both Old and New Worlds, possess a straight slender bill, convex towards its tip. The tarsi are elongated. The toes are long, and are bordered with a membranous fringe. These forms, as implied by their popular name, are more typically terrestrial than the familiar or true Pigeons. They walk easily on the ground, and subsist on seeds, &c. They are said rarely to perch on trees. The Crowned Pigeon (*Goura coronata*) of the Eastern Archipelago averages a turkey in size. It is so named from the presence of a head-crest of narrow straight feathers. The general body-colour is a grayish-blue. The Nicobar Pigeon (*Callenas Nicobarica*), inhabiting India, possesses plumage of brilliant colours. Its body-colour is a dark blackish purple; the neck-feathers being elongated, and possessing blue, red, and golden hues. The wings are coloured blue; the tail being white, and the back of a golden-green lustre. The tail-feathers resemble those of the Cock in their disposition. The Carunculated Ground Pigeon (*Geophilus carunculatus*) forms another species of the group. See illustrations at ORNITHOLOGY.

PIG-IRON. See IRON.

PIGMENTS, materials used for imparting colour, whether by dyeing, painting, or otherwise. (See DYEING.) The colouring substances used as paints are partly artificial and partly natural productions. They are derived principally from the mineral kingdom; and even when animal or vegetable substances are used for colouring they are nearly always united with a mineral substance (an earth or an oxide), because by themselves they have no body, which they acquire only by a mixture with a mineral. In painting the colours are ground, and applied by means of some liquid, which dries up without changing them. The difference of the vehicle used with the method of employing it has given rise to the modes of painting in water-colours, oil-colours, in fresco, in distemper, &c. For oil-painting mineral substances are more suitable than lakes prepared with minerals, because the latter become darker by being mixed with oil. Among the mineral colours are flake white (carbonate of lead, with an excess of oxide), strontian yellow (chromate of strontian), cadmium yellow (sulphuret of cadmium), yellow, Oxford, Roman, stone, brown, orange, puce, purple, and a great variety of other ochres, which are all oxides

of iron; Jaune de Mars and Indian red (also oxides of iron), vermilion (bisulphuret of mercury), palladium red (ammonio-perchloride of palladium), ultramarine (a compound of silicate of alumina and silicate of soda with sulphuret of sodium, which produces a blue colour by reacting upon the other two constituents), chromium green (sesquioxide of chromium), terre verte (silicate of protoxide of iron), amber (an iron ore with manganese), asphaltum, &c. Flake white is the best of all white pigments for a vehicle of oil or resin, but both it and all other whites of lead, which are in other respects the best whites, have the defect of becoming blackened through exposure to the foul gases common to most domestic atmospheres. Pictures which have been deteriorated in this way can, however, be restored by being allowed to experience the action of a strong light in a pure atmosphere. The lake colours have tin or alum for their basis, and owe their tint to animal or vegetable colouring substances. Among them are the red lakes, prepared from madder (which are regarded as the most enduring), cochineal, and of inferior quality from Brazil wood; the yellow from fustic, weld, &c.; the brown (Vandyke, Cappagh, Rubens, Cassel, and Cologne browns) from various decomposed vegetable matters mixed with bituminous matter. Indigo is a purely vegetable colour, as is also blue-black, which is obtained from burned vine-twigs. Ivory black is a purely animal colour, being nothing less than burned ivory. In staining porcelain and glass the metallic colours which are not driven off by heat and are not easily changeable are used. Gold containing tin gives a purple, nickel a green, cobalt a blue, iron and manganese black, uranium yellow, chrome green.

PIGMY. See PYGMY.

PIGNUT. See BUNUM.

PIKE, a genus of fishes belonging to the order Teleostei, and included in the Malacopteroles division of the order. The *Malacopteri Abdominales*, or section to which the pikes belong, includes those fishes which possess ventral fins placed towards the hinder aspect of the body. The Pikes form the types of the family Esocidae, in which group the body is lengthened, flattened on the back, and tapering abruptly towards the tail. One dorsal fin exists, this structure being placed far back on the body, and opposite the anal fin. The lower jaw projects, the biting edge of the upper jaw being formed by the maxillary and intermaxillary bones. Teeth are present in plentiful array, and are borne by almost every bone entering into the composition of the mouth. The body is clothed with *cycloid* scales, or those of a simple rounded variety. The pyloric cæca found attached to the stomach of most fishes are wanting in the Esocidae. The pikes inhabit the fresh-water lakes and rivers of temperate climates. The Common Pike (*Esox lucius*) occurs in the rivers of Europe, Northern Asia, and North America. The pike affords good sport to anglers, and its flesh is palatable and wholesome. Pikes form the tyrants of their sphere, being the most voracious of fresh-water fishes. They feed upon smaller fishes, upon frogs and other animals; and young ducks and other aquatic birds have been known to be dragged below the water and devoured by these fishes. Perches are said to escape the pike's attack owing to the presence of their spinal dorsal fins. When fully grown the pike may attain a length of 5 or 6 feet, and there are numerous instances on record in which these fishes have greatly exceeded that length. Of this description was the monster pike caught at Kaiserslautern, near Mannheim, in Suabia, in 1497, which is said to have measured 19 feet, and weighed 850 lbs. This same pike had attached to it a copper

ring, on which an inscription bore that the fish had been placed in the water by the Emperor Frederick II. on Oct. 5, 1230. This date made the fish at the date of its capture to have been at least 267 years old. These fishes grow very rapidly. The other species of *Esox* are confined to North America. See illustration at ICHTHYOLOGY.

The Sea Pike (*Belone vulgaris*), also known as spit-fish, gar-pike, gar-fish, and bill-fish, is included in the family Scomberosocidae. The body is long and of very slender conformation. It is covered with minute scales. The head is smooth, the jaws being elongated to form a slender beak-like structure. An entire dorsal and anal fin exists. (See illustration at ICHTHYOLOGY.) The Saury Pike (*Scomberosox saurus*) resembles the gar-pike in general conformation, but possesses the dorsal and anal fins in the shape of a number of divided 'finlets'.

The Bony Pike (*Lepidosteus osseus*) of North American lakes and rivers belongs to an entirely different order of fishes—that of the Ganoidei. It has therefore no structural relations with the ordinary and common pike. See BONY PIKE, and the illustration at the article ICHTHYOLOGY.

PIKE, a weapon much used in the middle ages as an arm for infantry, and still sometimes used by irregular and hastily armed troops. It was from 16 to 18 feet long, and consisted of a pole with an iron point. (See LANCE.) Men armed with it were called *pike-men*. After the invention of guns pikes gradually fell into disuse. The Prussian Landsturm was armed with pikes in 1813, to be used in case no better arms were to be had. The Swiss first substituted the halbert for the pike towards the fifteenth century. For some time every company in the armies of Europe consisted of at least two-thirds pike-men and one-third harquebusiers. Gustavus Adolphus, about 1630, omitted the pike-men in some regiments entirely.

PIKE'S PEAK, one of the highest summits of the Rocky Mountains (14,147 feet), in the centre of the state of Colorado. It was discovered by General Pike in 1806. It abounds in rich gold-bearing quartz. There is an observatory on the top which may now be reached by a railway.

PILASTERS, square columns usually set in a wall from which only one-fifth or one-fourth of their thickness stands out. See COLUMN.

PILATE, PONTIUS, one of the Roman procurators of Judea. He succeeded Valerius Gratus in A.D. 26. Nothing is known of his early history. He was a narrow-minded and impolitic governor, and at the very beginning of his term of office led to commotions among the Jews at Jerusalem, who had lived in perfect quietness for twenty years previously. He brought the Roman troops from Cæsarea, which was almost a purely Roman town, and where, accordingly, their presence was not likely to irritate the people, with whom they came little in contact, to Jerusalem, and endeavoured to introduce into the same city the Roman standards with the image of the emperor, in violation of the Jewish usages. He also appropriated the *corban*, a sacred revenue derived from the redemption of vows, to defray the cost of an aqueduct which he built to supply the city with water, and put to death some Galileans in the midst of the sacrifices, which latter act brought upon him the hostility of Herod, tetrarch of Galilee. When Christ had been condemned to death by the Jewish priests, who had no power of inflicting capital punishments, he was carried by them to Pilate to be executed. Pilate, seeing nothing worthy of death in him, sent him, as a Galilean, to Herod, who, however, sent him back to Pilate. Yielding to the clamours of the Jews, the Roman

governor finally ordered Jesus to be executed, but permitted Joseph of Arimathea to take his body and bury it. Pilate was afterwards removed from his office by Vitellius, prefect of Syria (A.D. 36), and, according to tradition, was banished by Caligula to Vienna (Vienne), in Gaul, where he is said to have died or committed suicide some years after. The Acts of Pilate, written in Greek, as well as two Latin letters purporting to have been written by Pilate to the emperor, are spurious.

PILATUS, MOUNT, a mountain in Switzerland, on the borders of the cantons of Lucerne and Unterwalden, south of the town and near the Lake of Lucerne. Its loftiest peak, the Tomlishorn, attains a height of 6998 feet. Formerly the ascent was dangerous and rarely attempted, but a convenient path up the mountain, and recently a railway, having been made, it has become as great a favourite with mountain climbers as the Rigi on account of the imposing views of the Bernese mountain scenery obtained from various points. Mons Pilatus is associated in the imagination of the people with more legends than any other locality in Switzerland. Its ravines are popularly believed to be the haunt of dragons and goblins, and the mountain itself is supposed to have got its name from Pontius Pilate, who, smitten by remorse for the share that he had in the death of Christ, is believed by the inhabitants of that district to have put an end to his life by plunging into a gloomy lake which exists on the summit of the mountain. Superstition adds that a human figure is sometimes seen to rise from this lake and go through the operation of washing his hands, after which a mist gathers about the lake and gradually envelops the whole mountain, presaging a storm. Reference is made to this legend in the beginning of Scott's *Anne of Geierstein*. Some have supposed that the name of the mountain is really a corruption of *mons pileatus*, that is, 'hatted mountain,' a name which would be explained by the fact that it is frequently seen capped with clouds, but the true meaning of the name appears to be 'pillar mountain,' from the Latin *pila*, a pillar.

PILCHARD (*Clupea pilchardus*), a species of fishes included in the family and genus of the Herrings (*Clupeidæ*), and popularly known as the Gipsy Herring. The pilchard closely resembles the herring, but is of smaller size. As in the latter fishes the body is compressed and covered with large cycloid scales, which are readily removed. The upper lip is entire, the mouth being of moderate size. The pilchards, like the herrings, were formerly accounted migratory fishes, in that they retreated to the northern or Arctic seas during the summer and appeared round the British coasts in winter and spring. The pilchards, however, have been ascertained to frequent the coasts of Britain all the year round, and they may therefore be accounted native fishes. The usual spawning time is October, although the pilchard has been known to deposit eggs in May. Mr. Couch and other authorities maintain that these fishes breed once a year only. The food consists chiefly of Crustacea and analogous organisms. These fishes are found in greatest plenty on the southern coasts of England, the Cornwall pilchard fisheries being those best known and most celebrated. The fishery is more or less continuously carried on, but the month of July appears to be that in which the operations proceed with the greatest vigour. Shoals of pilchards then appear, including immense myriads of fishes, which are taken by means of the 'seine net'—a contrivance by means of which the shoal is surrounded by nets, after the fashion of a huge pocket, the limits of which are gradually lessened as the net is worked towards shallow water, the fish

being taken out by the 'tuck net' as the tide recedes. Watchers, locally known as 'huers,' are stationed on heights and rising ground to inform the fishermen waiting in their boats below of the approach and locality of the pilchard shoals. The pilchards are packed in hogsheads, which each contain about 3000 fishes. Upwards of 10,000 such hogsheads have been filled in a single day's fishing at one port. These fishes are salted and cured, and are then piled into great stacks, from which a valued oil exudes. They remain four weeks in these stacks, and are then washed to free them from the oil, packed in barrels, and afterwards exported. The pilchards are chiefly consumed in Spain, Italy, and France during Lent and other fasting seasons. Of late years quantities of pilchards are preserved in oil, after the fashion of sardines, and exported as articles of food and as table delicacies, preserved in hermetically-sealed tins. Many of the commercial 'sardines' are in reality pilchards, the sardine (which see)—*Clupea sardina*—being also included in the Herring genus. (See the illustration at ICHTHOLOGY.)

PILCOMAYO, or **ARAGUAI**, a river in South America, rises in Bolivia, on the eastern declivities of the Andes, near lat. 19° s.; lon. 67° w., from which point it flows s.e., passing a little to the south of Chuquisaca under the name sometimes of the Cachimayo to about lat. 20° 40' s.; lon. 62° 53' w., where it is joined by the Pilaya; thence it flows south-west and s.s.w. between the Argentine Republic and Paraguay, and falls into the Paraguay about 6 miles below, or south of Asuncion; lat. 25° 20' s.; lon. 57° 40' w. Its entire length is between 1500 and 1600 miles. On account of its shallowness during the dry season and the great current in its narrow parts it does not appear likely to become usefully navigable. About 100 miles from its mouth it divides into two branches, the north or main stream, called Pilcomayo or Araguaí Guazu, and the south Araguaí Mini; the latter enters the Paraguay by two mouths, 24 miles apart, and the most northern one 9 miles south from the mouth of the main stream.

PILES. See HEMORRHOIDS.

PILES, in works of engineering, are used either for temporary purposes or to form a basis for permanent structures. In the former case they are usually squared logs of wood sharpened at the point, which is sometimes protected with an iron shoe to enable it to penetrate the harder strata which it may meet with in being driven into the ground. The method of placing them is by means of a heavy weight which is raised to a height and then allowed to fall perpendicularly on the top of them. Steam is now generally employed to raise the weight in this operation. (See STEAM-HAMMER.) If while being driven into the ground the piles should manifest signs of splitting at the top they are protected by iron rings. The most usual purpose to which piles are applied in temporary structures is to make coffer-dams. They are driven close together in a circle round any part where engineering operations are to be carried on below the level of the surrounding water. When the circle has been completed the water is pumped out of the inclosed space, and the operations, such as laying the foundations of piers, abutments, &c., can then be performed on dry land. When the pressure outside is greater than a single row of piles is able to resist then a double row is made with an intervening space of 3 feet or more, which is filled up with clay, sand, and other materials well rammed in, or, to use the technical term, puddled. The permanent purposes for which piles are employed are various, but in all cases the object is to secure a firm foundation in a loose or swampy soil. In these cases the piles used are for the most part of cast-iron, sometimes solid

and sometimes hollow. The method of driving them is generally the same as with wooden piles, but in two kinds of piles special methods are used. The one of these is the screw-pile, invented by Mr. Mitchell, which consists of a long shaft of malleable iron, with a broad disk at the foot made on the under side in the form of a screw. This kind of pile is inserted in its place by means of a capstan, which works the pile into the ground like a screw-driver. Piles of this kind are found very useful in loose and shifty soils. The other kind is that patented December 5, 1843, by Dr. J. L. Potts. His pile is hollow, and is sunk by having the air within it exhausted by an air-pump, which draws the sand and water up from the bottom of the pile and conveys it to the receiver of the air-pump. As the sand is removed in this way the pile continues to sink until it reaches a solid foundation. If a single pile is not long enough for this purpose another may be fitted into the top of the first, and this may be repeated as often as is necessary. A recent form of pile is the Hennebique ferro-concrete one, patented in France, and now in use in other countries. It consists of steel rods embedded in Portland cement.

PILEUS. See FUNGI.

PILGRIMAGES. The practice of making pilgrimages to places of peculiar sanctity is as ancient as it is wide-spread. The ancient Egyptians and Syrians had privileged temples, to which worshippers came from distant parts. The chief temples of Greece and Asia Minor, those of Athena at Athens, of Artemis at Ephesus, Zeus at Olympus, Hera at Samos, Aphrodite at Amathus, Paphos, Cnidos, and Cythera, Æsculapius at Epidaurus, swarmed with strangers, whose object in visiting these shrines was the same as that of Christian pilgrims in visiting Jerusalem, or of Mohammedans in visiting Mecca. The Jews likewise were required by the Mosaic law to go up to Jerusalem once a year, at a fixed time, to hold the feast of the passover; and that also was a kind of pilgrimage. But it is in Christianity and Mohammedanism that the practice has attained its greatest development. The first Christian pilgrimages were made to the graves of the martyrs. Helena, the mother of Constantine, made a journey to Jerusalem to visit the grave of Christ, and her example found many imitators. St. Augustine describes the tomb of St. Stephen as thronged with pilgrims, and various other early Christian writers bear similar testimony. Indeed by this time (end of fourth and beginning of fifth century) the custom had become so general as to lead to abuses, and St. Jerome and Gregory of Nyssa, both of whom lived about the same time as St. Augustine, or rather earlier, zealously endeavoured to check the practice as tending to great moral corruption, an objection that has always been made to pilgrimages when they have become common and are undertaken in large promiscuous assemblies. Throughout the middle ages, and especially about the year 1000, the religious fervour of the people manifested itself in numerous pilgrimages, especially to Jerusalem. At that time the Holy Sepulchre was in the hands of the Saracens, who had at first treated the Christian pilgrims, from whom they derived considerable profit, with lenity; but from about the beginning of the tenth century, when Jerusalem came under the power of the fanatical sect of the Fatimites, the pilgrims were made the victims of all forms of outrage. The continuance of this treatment, in the course of about two centuries, gradually produced such a spirit of indignation throughout the Christian world as prepared the minds of the people for those expeditions (the Crusades) for the recovery of the Holy Sepulchre, which were themselves nothing else than gigantic armed pilgrimages, and which also had

a powerful effect in stimulating the desire of making pilgrimages to the Holy Sepulchre among those who did not join the Crusades, and at times when no crusade was in progress. But the Holy Sepulchre was not the only goal of Christian pilgrims. Pilgrimages were performed in the middle ages to many different places. Some spots, however, attracted a much larger concourse than others, the credulity of the time associating with them peculiarly great or numerous miracles, or peculiarly extensive indulgences being granted to the pilgrims who visited them. The shrine of Our Lady of Loretto, near Rome, that of St. James of Compostella in Spain, of St. Martin of Tours in France, were all sacred spots to which, from the tenth to the thirteenth century, and even much later, pilgrims resorted in innumerable crowds; and from the end of the twelfth century the shrine of St. Thomas Becket at Canterbury had the same honour in England. The following instance will show to what extent pilgrimages even to distant places were performed as late as the year 1428. At that date there went to the shrine of St. James of Compostella in Spain, from London, 280 pilgrims; from Bristol, 200; from Weymouth, 122; from Dartmouth, 90; from Yarmouth, 60; from Plymouth, 40; from Exeter, 30; from Liverpool, 24; and from Ipswich, 20—in all 866 pilgrims from nine towns. After the Reformation the practice of making pilgrimages fell more and more into abeyance, and the spirit which led to it seems almost to have become extinct among Christians, although there are still occasional outbursts of it in the Roman Catholic communion, as in the year 1825, when Leo XII. proclaimed a jubilee, and large numbers of pilgrims flocked to Rome from all parts of Christendom; and again in France in 1872, and more especially in 1873, when various sacred localities in that country, but above all Paray-le-monial, were visited by pilgrims from all parts of France, and even from foreign countries, including England. Roman Catholic pilgrims still visit this place, as well as Lourdes, Iona, Holy Island, &c.

During the middle ages, when pilgrimages were at their height, it is acknowledged that they were to a great extent noxious in their effects. The plea of being about to undertake a pilgrimage to some honoured shrine was made by the poor the excuse for mendicancy, by which they often amassed considerable sums of money, which were nearly as often squandered at Rome, or whatever other place the pilgrims might be destined for, in all kinds of excesses. On the other hand, it has often been pointed out that they served as a great means of communication between different nations, and thus promoted commerce and the diffusion of many arts and improvements.

For Mohammedans the great place of pilgrimage is Mecca, the birth-place of the founder of their religion, and the place where stands the Kaaba, or sacred altar, which is believed by Mohammedans to have been originally built by an angel, and which made Mecca the resort of Arabian pilgrims long before the time of Mohammed. Every year just before the feast of Bairam large caravans arrive at Mecca from all quarters. The persons who join these caravans have usually two objects in view—first, that of performing a religious duty, and second, that of doing some business; for these pilgrimages to Mecca serve commercial purposes to a much larger extent than those of the Christians in the middle ages. As much licentiousness is said to prevail in these Mohammedan assemblies as ever disgraced the Christian pilgrimages. Among the Hindus and the Buddhists also the practice of performing pilgrimages largely prevails. In India the principal resorts of pilgrims are

the sacred city of Benares; the rock-out temples of the island of Elephanta; the pagoda of Juggernaut, in the province of Orissa; the temple of Ellora, in the Nizam's Dominions; &c. Among the Buddhists certain pagodas in China, and the most revered monasteries of the adherents of Lamaism in Tibet and Tartary, are visited by numerous pilgrims.

PILGRIM FATHERS, the name given to the English, Scotch, and Dutch Nonconformists, who, sailing from Southampton in the *Mayflower*, landed at what is now Plymouth in Massachusetts, December, 1620, and colonized New England.

PILLAR. See **COLUMN**.

PILLAR-SAINTS. See **STYLITES**.

PILLAU, a fortified seaport of East Prussia, 25 miles w.s.w. of Königsberg, at the southern extremity of a narrow peninsula formed by the Baltic and the Frisches Haff. The port is safe and commodious, and all vessels going to Königsberg or Elbing stop here. It is connected with Königsberg by railway. Much fishing is carried on here. Pop. (1895), 3189.

PILLIBHIT, or **PILLIBHEET**, a town in India, in the North-west Provinces, 30 miles north-east of the town of Bareilly on the Deoha river. It is the entrepôt for an extensive traffic between the upper and lower country, more especially for rice, which is celebrated over India for its excellence. Sugar-refining is carried on. Pop. (1891), 33,799.

PILLNITZ, a palace of the King of Saxony, on the right bank of the Elbe, 7 miles from Dresden. The court remains here annually for some time. Its situation is very beautiful. In history Pillnitz is famous for a meeting of the Emperor Leopold II., Frederick William II. of Prussia, the Count of Artois, the ex-minister Calonne, and several other personages, from August 25 to 27, 1791. A treaty of offensive alliance was not concluded, but preliminaries were agreed on for a defensive alliance between Austria and Prussia, which was settled at Berlin, Feb. 7, 1792. The French were greatly irritated by this convention, which they considered as the basis of the coalition of Europe against France.

PILLORY, a frame of wood erected on posts, with movable boards, and holes through which were put the head and hands of a criminal for punishment. In this situation criminals in Britain were formerly often exposed to the outrages of the mob in a way inconsistent with any rational notions of punishment. Those who were offensive to the crowd were in no small danger from the missiles by which they were assailed. The culprit was allowed to make speeches, defending himself and attacking his enemies. In 1816 this punishment was abolished in all cases except that of perjury, and it has since been abolished altogether (by act 1 Vict. cap. xxiii., June 30, 1837).

PILLS, medicines made up in globules of a convenient size for swallowing whole. Their ordinary weight is 5 grains. Some vegetable substances used as medicines may be made into pills without the addition of any other material, but usually the substances having medicinal properties are not of the proper consistence to be made into pills by themselves, and require the addition of some other material, which is called an excipient. The usual excipients are bread-crumbs, hard soap, extract of liquorice, mucilage, syrup, treacle, and conserve of roses. The last two are the most valuable, preserving the proper consistency of the pills for a very long time. The materials of which pills are made are mixed together in a mortar until they are perfectly homogeneous, and are afterwards divided into pills with instruments devised for the purpose. To prevent them from adhering to one another, as well as to some extent to conceal the taste, they are covered with some fine powder, such as liquorice powder, wheat flour, fine

sugar, and on the Continent lycopodium, which is very much used there. Instead of this powder pills sometimes receive a thin coating of gold or silver. Pills are a highly suitable form for administering medicines which operate in small doses, or which are intended to act slowly, or not to act at all until they reach the lower intestines, and in some other cases.

PILOT and PILOTAGE. A pilot is a person qualified to navigate a vessel within a particular district. The pilots of the United Kingdom are formed into associations at different places by ancient charters of incorporation, or by particular statutes. The principal of these associations are the Brotherhood of Trinity House of Deptford Strond; the Fellowship of the Pilots of Dover, Deal, and the Isle of Thanet, or the Cinque Port Pilots; and the Trinity Houses of Hull and Newcastle. The law relating to pilots and pilotage is contained in acts 16 and 17 Vict. cap. cxxix.; 17 and 18 Vict. cap. civ. (Merchant Shipping Act of 1851), Pt. v.; and other acts, mostly superseded by the Merchant Shipping Act of 1894 (57 and 58 Vict. cap. lx.). The Trinity House of Deptford Strond is intrusted with the general regulation and superintendence of pilotage for the United Kingdom, and has in addition the entire administration within certain districts. These are, 1st, the London District, comprising the Thames and Medway up to London Bridge and Rochester Bridge respectively, and the seas or channels leading thereto from Orfordness on the north to Dungeness on the south; 2nd, the English Channel District, from Dungeness to the Isle of Wight; 3rd, the Trinity House Outport Districts, which consist of those for which no particular provision is made by any act of Parliament or charter. It is compulsory upon all vessels above 60 tons burden, except coasting vessels not carrying passengers, ships bound to Boulogne or to any place north of Boulogne, stone-laden ships from the Channel Islands, and ships navigating within the limits of the port to which they belong, to have on board, within the London District and the Outport Districts of Trinity House, a pilot qualified to act within the limits of such districts, unless the vessel be merely passing through these limits without loading or unloading at any port within them. In the districts beyond the administration of the Trinity House of Deptford Strond the obligations to and exemptions from compulsory pilotage which existed before the Merchant Shipping Act of 1854 were continued by that act; but the various pilotage authorities were empowered, with the sanction of an order in council, to make new exemptions or extend those already in use. Pilotage authorities may also, with the same sanction, alter and reduce the rates of pilotage, arrange the limits of pilotage districts, and make by-laws for various other objects; but if any such by-law, or any pilotage regulation in force previous to the passing of the act, is appealed against by the majority of the pilots, by the local marine board, or, where there is none, by six masters, owners, or insurers of ships, it may be revoked or altered by the board of trade. The board of trade may also appoint a new pilotage authority for a port under the jurisdiction of the pilotage authority of another port, unless that pilotage authority happen to be the Trinity House of Deptford Strond. Every qualified pilot on his appointment receives a licence for a particular district from the pilotage authority of that district. Masters or mates of any ship may, upon giving due notice, be examined and passed by the pilotage authorities, and receive pilotage certificates. In this case they must be renewed every year. Further, any master or mate of a ship may obtain from the board of trade, after examination, a certificate to the effect that he is authorized to pilot any

ship or ships belonging to the same owner of and under a certain draught of water. Any qualified pilot who keeps, or is interested in keeping, a public house, or in selling wine, spirits, tobacco, and tea; or who commits any fraud against the customs or excise, or is guilty of corrupt practices as to ships, cargoes, crews, or passengers; who lends his licence, acts as pilot whilst suspended or when drunk, causes unnecessary expense to enhance his own or some one else's gain; declines, without reasonable cause, to go off when signalled for or required; unnecessarily cuts or slips a cable; refuses to conduct a ship into port, except on reasonable ground of danger to the ship; or leaves the ship of which he is in charge, without the master's consent, before the service for which he was hired has been performed—renders himself liable to suspension or dismissal, as well as to a penalty not exceeding £100, in addition to damages to the persons aggrieved. Pilot boats must also be approved and licensed by the pilotage authorities. They must be painted black outside, and have the name of the owner and port in three-inch letters on the stern, number of licence on the bows, and a large flag with the upper half white and the lower half red; and whenever a pilot is carried off to a ship in a boat not belonging to the pilotage service he must exhibit a pilot's flag. Pilotage fees depend on the draught of water of the ship piloted, and for vessels with a large draught of water are very much higher than for those with a small one. In Britain no owner or master of any ship is answerable to any person for any loss or damage occasioned by the fault or incapacity of any qualified pilot acting in charge of such ship within any district where the employment of such pilot is compulsory; but the pilot must not be interfered with in the discharge of his duties. Other maritime countries have also passed laws to regulate the pilotage of vessels. In the United States each individual state makes its own regulations as authorized by acts of Congress. The most important body of pilots in the United States are those under the pilot commissioners of New York. The master of a vessel with a pilot on board has still the management of the vessel, and sees that she is kept in the course the pilot directs. A master refusing to take a pilot vitiates the insurance on the vessel.

PILOT FISH (*Naucrates ductor*), a genus of Teleostean fishes included in the Carangidae or Horse-mackerel family. The pilot fish derives its popular name from its habit of following ships for long distances, led probably by the expectation of food being thrown overboard. It is also credited with leading sharks towards food, being frequently seen accompanying the larger fishes, although observers have stated that they have noticed sharks prevented from seizing a bait by several pilot fishes, and that when the shark had actually seized the morsel the smaller fishes clung to the shark's body as it was being pulled out of the water. The ancients, who called them *pompili*, credited the pilot fishes with the labour of directing the mariner in his proper course when he had lost reckoning of his way. Probably a similar instinct and desire for food, more than any other or more mysterious relationship, causes the association of these fishes with the sharks. The average length is about 12 inches. In general form it resembles the mackerel. Its colour is a silver-gray, merging into blue on the back, whilst the body is marked by five encircling bands of a dark-blue colour. One dorsal fin exists, and free spines exist before this, and also before the anal fin.

PILPAX, or **BIDPAL**, the reputed author of a collection of fables which have been circulated for about 2000 years in numberless translations and redactions, among all the nations of the East and

West. The careful investigations of Colebrooke, Wilson, Sylvestre de Sacy, Loiseleur des Longchamps, and Benfey have succeeded in tracing the origin of this collection, its gradual development, and the various changes it has undergone. The original source is the old Indian collection of fables called Panchatantra, which is ascribed to one Vishnunarman, and which acquired its present form under Buddhist influences not earlier than the second century B.C. It was afterwards spread over all India, and handed down from age to age in various more or less different versions, and in translations into all the languages of Northern and Southern India. The collection of fables known under the name of Hitopadesa is chiefly based on this older collection. The old Indian Panchatantra was translated into Pehlevi under the title of Kalila and Dimna (the names of two jackals who appear in the first fable), in the sixth century of our era, by Barfuye, physician to King Nushirvan the Great, by whose order the translation was made. Thus Pehlevi translation was itself the basis of a translation into Arabic, which was made in the eighth century under the Caliph Almansor; and this latter translation is the medium by which these fables have been introduced, directly or indirectly, into the languages of the West. This Arabic Kalila and Dimna was translated (1) into Greek by Symeon Seth about 1080 (Athens, 1851); (2) into Hebrew by the Rabbi Joel about 1250; and (3) into Spanish under Alfonso X. of Castile, also about 1250. The Hebrew version was rendered into Latin between 1263 and 1278 by John of Capua, and the Spanish one was rendered into the same language by Raymond of Béziers about 1313; and one or other of these two Latin versions was followed in nearly all the translations by which these fables were first introduced into modern European languages. The first English translation was published in 1570 by Sir Thomas North. His translation was reprinted in 1888. The Sanskrit text of the Panchatantra was published by Kosegarten at Rome in 1848-59, and by Buhler and Kielhorn at Bombay in 1868-69. A German translation by Benfey, with an introduction tracing the stories through their subsequent history, appeared at Leipzig in 1859; there is also a French translation with valuable preface and notes by Edouard Lancereau (Paris, 1871).

PILSEN, a town in Bohemia, at the confluence of the Radbuza with the Mies (Beraun), 53 miles S.W. of Prague. It consists of the town proper and extensive suburbs; is a well-built, handsome place; has a splendid Gothic church of the thirteenth century; a town-house, Franciscan monastery, a German and a Czech theatre, German and Czech gymnasia, barracks, and important and varied industries, embracing machinery and metal wares, porcelain, glass, liqueurs, refined spirits, &c., and large breweries which send out a famous variety of beer. Coal, iron, and alum are worked in the neighbourhood, and there is a considerable trade. Pilsen possessed a printing-press as early as 1475. It was once a fortified town, and was several times besieged during the Hussite wars. In 1618 it was stormed by Mansfeld, and in the Thirty Years' war was for a time the head-quarters of Wallenstein. Pop. (1880), 38,883; (1890), 50,221; (1900), 68,292.

PIMENTO, or **PIMENTA**. See **ALLSPICE**.

PIMPERNEL (*Anagallis*), a genus of plants belonging to the natural order Primulaceæ, and distinguished by a caducous, wheel-shaped corolla, stamens with bearded filaments, and with anthers fixed behind. The fruit is a pyxis or capsule opening by a cup-shaped lid. The *Anagallis arvensis*, or Field Pimpernel, is a beautiful annual, which grows in cultivated districts, and is common nearly everywhere in Europe,

as well as in many parts of Asia. Its stem is creeping and branching; the corolla exceeds the calyx but little. The flowers are sometimes scarlet, with a purple spot in the centre, and sometimes blue. These two kinds are sometimes regarded as distinct species, called respectively *Anagallis phænicea* and *Anagallis cærulea*, and sometimes only as varieties. This species is commonly known in England (where the scarlet-flowered variety is by far the most common) as the 'poor man's weather-glass,' from the fact that its flowers do not open in rainy weather. In fine weather they open about eight in the morning and close about noon. The Bog Pimpernel (*Anagallis tenella*) is an extremely delicate and beautiful plant, which grows in the drier parts of marshes in England, but is seldom seen in Scotland. Its flowers are red, and it is distinguished from the Field Pimpernel by the fact that its corolla considerably exceeds the calyx. The blue and lilac varieties of the *Anagallis collina*, originally a native of South Africa, have been introduced into gardens in Great Britain, where they have a fine effect.

PIN, a piece of wire, generally brass, sharp at one end and with a head at the other, chiefly used by women in adjusting their dress. By the old methods of manufacture the distinct processes were usually said to be fourteen, beginning with straightening the wire after it had been thoroughly cleaned and brought to the required size. The straightening was effected by drawing it between iron pins fixed in a board in a zigzag manner. The wire was thus run out into lengths of 30 feet, which were again cut into shorter pieces, each sufficient for three, four, or six pins. Pointing was done by grinding the ends upon stones or steel cylinders, thirty or forty of the wires being held together in the hands and made to rotate as their ends were applied to the grinding surfaces. A lad of twelve years of age could thus point 16,000 in an hour. They were then cut into the right lengths, and the bits not pointed were returned to the pointer. The pin-heads, made of a finer wire, were prepared by winding them by a lathe into a spiral round other wires. Three turns of the spiral being cut off furnished the head for one pin. The heads were annealed by being brought to a red heat, and then shaped by the blow of a hammer. Each one being taken up on a pin-wire, and this introduced point downward in a hole in the centre of a die, a blow from a drop-hammer worked by a treadle secured the head to the pin. Several additional processes were necessary for preparing the pins for market, and though the pins are now made almost entirely by machinery these processes still remain much the same. They are cleaned by boiling them half an hour in sour beer or solution of tartar. To whiten or tin them they are laid in a copper pan, in alternating layers with grain-tin, and when the vessel is nearly full water is added and heat applied; when hot some cream of tartar is added, and the boiling is continued for an hour. To give them a polish they are put into a tub containing a quantity of bran, which is set in motion by turning a shaft that runs through its centre, and thus by means of friction the pins become entirely bright. Sticking the pins in papers was formerly a source of employment to great numbers of women and children about the pin-factories, but this is now done by an ingenious and complicated machine. Solid-headed pins, which are those now universally in use, were first made in 1824 by a machine invented by Mr. Wright of the United States. Various improvements have since been introduced, especially by Mr. Howe, and the machines now used, which complete the pin to the colouring and polishing, are altogether too complicated for a particular description.

PINA CLOTH, an extremely soft and delicate fabric, the manufacture of which is peculiar to Manila. It is made from the unspun fibres of the leaves of the cultivated pine-apple plant (*Ananassa sativa*), and the finer qualities are always made in small pieces, since only single fibres are used for them. For the coarser qualities several fibres are often joined together, so as to make warp threads of considerable length. Its colour is almost white, but has a slight tinge of yellow in it. In spite of the delicacy of its texture it is remarkably strong. Its chief use is for making ladies' pocket handkerchiefs, but it is sometimes also used for dresses. It is frequently adorned with exquisite embroidery.

PINACOTHEK, or PINAKOTHEK (Greek *pinakothēkē*), a name sometimes applied in Germany to galleries of art, especially collections of paintings. The Pinacothek formed by Louis I. of Bavaria at Munich is particularly famous.

PINCHBECK, an alloy of copper, known also under the names of *imitation bronze*, *tombac*, *Mannheim gold*, *prince's metal*, &c. This alloy contains about 80 per cent. of copper and 20 per cent. of zinc, lead and a little tin being also sometimes present. It is cheaper than true bronze, which is an alloy of copper and tin, and is much used for making ornamental articles.

PINCKNEYA PUBENS, or GEORGIA BARK, a small tree closely resembling the cinchona or Peruvian bark, and said to possess the same febrifuge qualities, growing wild in the southern parts of Georgia. It belongs to the natural order Cinchonaceæ. It rarely exceeds 25 feet in height, by 5 or 6 inches in diameter at base; the leaves are opposite, 5 or 6 inches long, oval, and acute at each extremity; the flowers are pretty large, white, with longitudinal stripes of rose-colour, and are disposed in beautiful clusters at the extremities of the branches: each flower is accompanied with a floral leaf, bordered with rose-colour near the upper margin; the corolla is tubular; the stamens five, with a single style; and the capsule contains two cells and numerous seeds. The wood is soft and unfit for use in the arts. The inner bark is extremely bitter, and is the part employed with success in intermittent fevers.

PINDAR, the most impetuous and sublime of the lyric poets of Greece. Pindar was born in Boeotia, in or near Thebes, of a noble family, in the sixty-fifth Olympiad, about 522 B.C. His father, or his uncle, is said to have been a flute-player, and he is said to have been himself a masterly performer on the lyre. At an early age he was instructed in music and poetry; and for the development of his poetical talent he was sent to Athens, where he became the pupil of Lasus of Hermione, the founder of the Athenian school of dithyrambic poetry. In after-life he showed himself a great admirer of Athens and the Athenians, who rewarded him during his lifetime for the honours he paid to them by making him a public guest of the city and giving him a present of 10,000 drachmas, and after his death erected a statue in his honour. On his return to Thebes he was especially indebted for the further cultivation of his poetic gifts to the beautiful Corinna, who was herself a distinguished poet, and is said to have obtained the prize more than once in the poetic competition with her friend. He was held in great honour by many princes of Greek states, for whom he composed choral songs. Alexander, king of Macedonia, was one of his most ardent patrons, and it was probably in gratitude for the praises Pindar bestowed upon him that his descendant, Alexander the Great, gave orders that Pindar's house in Thebes should be spared when the rest of the city was destroyed. Little else is known with certainty of his life; even the date of his death

is doubtful; according to some he died in his sixty-fifth year, according to others he lived to the age of eighty or ninety. The most probable account appears to be that he died at the age of eighty, in which case his death would fall about 442 B.C. He practised all kinds of lyric poetry, and excelled equally in all. His works embraced hymns to the gods, psalms, dithyrambs, dancing and drinking songs, dirges, panegyrics on princes, and hymns in honour of the victors of the games, but the only poems of his, with one exception, which have come down to us entire belong to the last class, the Epinicia. The one exception referred to is the ode which appears in editions of Pindar as the eleventh Nemean, and which was intended to celebrate the installation of Aristagoras as prytanis at Tenedos. Forty-five of the epinician odes of Pindar are still extant (including the one just mentioned). Fourteen of these are in celebration of Olympic victors, twelve of Pythian, eleven of Nemean, and eight of Isthmian. Not only the conquerors and their fellow-citizens, but all assembled Greece, was celebrated in his poems, and thus they were soon spread wherever the Greek language was spoken. To understand Pindar it is necessary to be intimately acquainted with Greek antiquities. In the judgment of the best critics his poems belong to the most beautiful remains of ancient literature. Fragments of his other works have also been preserved. Of the editions of Pindar the following deserve to be recommended:—those of Boeckh (Leipzig, 1811–22, two vols.); Disson (second edition, by Schneidewin and Leutsch, Götting, 1843–65); Bergk, in the *Poetae Lyrici Græci* (fourth edition, Leipzig, vol. 1., 1878); Mommsen (Berlin, 1864); Christ (Leipzig, 1896); and Fennell (Oxford, 1879–83). His odes have been translated into English by F. A. Paley and others.

PINDAR, PETER. See WOLCOT.

PINDAREES (that is, *freebooters*), the name given to the hordes of mounted robbers in Central India who for several years (after 1812) infested the possessions of the East India Company. In the autumn, when the Nabada is so low that it is fordable by cavalry, they entered into the rich territory of the Company, devastated the country, and carried off the spoils to their mountains. These freebooters had existed since 1761, but made themselves particularly formidable in the beginning of the following century. They were descended mostly from the caste of Mohammedan warriors, which formerly received high pay from the Indian princes. But the British East India Company disarmed many of the tributary native princes, and maintained under the command of the British residents at the Indian courts large bodies of mercenary troops, which the mediatized nabobs were obliged to pay. The number of the Pindarees was thus increased, and they were secretly excited by the Indian tributaries to attack the Company. In 1817 the British governor-general, the Marquis of Hastings, determined on the destruction of these robbers, whose force was estimated at 40,000 horse. Attacked on all sides, they were conquered and dispersed. Garrisons were placed in some fortresses, and hostages taken to Calcutta; their other strong places were demolished. A flying party of sepoy was kept without intermission on the right bank of the Nabada, &c. At last a moderate yearly tribute was imposed on the subjected tribes.

PINDEMONTE, CAVALIERE IPPOLITO, an Italian poet, was born at Verona in 1753, and at the age of eighteen years distinguished himself by his poetical productions. Having travelled through Italy, France, and Britain, he preserved the impressions made on him by his journey in his *Viaggi*. In his *Poesie Campestri* he speaks with enthusiasm of British scenery and life. His *Arminio*, a tragedy founded on

the death of Arminius, contains choruses of warriors and virgins which are models of style. His lyric poems are among his best works, and display a depth of thought and feeling with which the author seems to have been inspired by British literature. Besides translations from Homer, Virgil, Ovid, and Catullus, his *Fata Morgana*, *Elogia di Gessner*, and *Il Colpe di Martello*, are worthy of notice. Pindemonte died in 1828.—His brother, the MARQUIS GIOVANNI PINDEMONTE (born 1751, died 1812), was the author of some dramatic works—*Componenti Teatrali*—and translated Ovid's *Bemedia Amoris*.

PINDUS, the ancient name of the principal mountain range of northern Greece, running from north to south about midway between both seas, and forming the boundary between Thessaly and Epeirus. In its northern part it was called Lacomon or Lacomus (now Metzovo), and here the largest rivers of Greece had their origin—such as the Peneius, Achelous, and Haliacmon. It was, like Helicon and Parnassus, a seat of Apollo and the Muses.

PINE. The natural order *Coniferae*, of which the pine is the most important genus, is divided into two sub-orders, namely, 1. *Abietinae*, the fir tribe; and 2. *Cupressinae*, the cypress tribe. The general characters of the order are the following:—Trees or shrubs, with disc-bearing woody tissue; linear or lanceolate leaves with parallel veins, sometimes clustered, and having a membranous sheath at the base; flowers unisexual, the male in deciduous catkins, the female in cones; no style nor stigma; ovules naked, one, two, or several at the base of each scale; fruit a cone formed of hardened scales; embryo included within a fleshy, oily albumen. In the *Abietinae* the ovules are inverted, and the pollen is oval or curved. In the *Cupressinae* the ovules are erect, the pollen is spheroidal, and the cone occasionally succulent, as in the *gambulus* of the juniper. The leaves of all the species of pines may be classed according to the number united in a sheath. All the European species, except *P. Cembra*, have only two leaves in a sheath; most of the Asiatic, Mexican, and Californian kinds have three, four, or five leaves, and those of the United States and Canada have generally three. The cones also afford an important ready means of classification.

The Scotch Pine or Fir (*P. sylvestris*) is a tall, straight, hardy tree, from 60 to 100 feet high; a native of most parts of Europe, flowering in May and June, and, as might be expected from its wide geographical range, having many varieties. Its leaves are rigid, in pairs, somewhat waved and twisted, slightly concave on the upper and convex on the under surface; light bluish green, finely serrulated on the edges; the cones from 2 to 3 inches in length, and 1 inch to 1½ in breadth; scales from 1 inch to 1½ long, terminating in an irregular four-sided point, often recurved. The bark is of a reddish tinge, comparatively smooth, in some varieties scaling off, and in others rough and furrowed. The branches are disposed in whorls, from two to four or five or six together, at first slightly turned up, afterwards taking a horizontal direction, and finally becoming somewhat pendant, except those branches forming the summit of the tree. The leaves are distinguishable from those of all other pines in which they occur in pairs by their glaucous hue, especially when young. The Scotch Pine always occurs in masses; it is considered full grown and fit to be cut down for timber in fifty or sixty years; but in the north of Scotland, where pine forests grew to perfection in former times, the tree continued to increase in bulk for three or four centuries. The quality of the timber varies with soil and climate, but the best wood is said to be produced in cold situations. Its durability, according to

Brindley the engineer, is equal to that of the oak. The tree is most abundant in the north of Europe, between latitude 52° and 65°. There are extensive forests of it in Russia, Poland, Sweden, Norway, Germany, the Alps, the Pyrenees, and the Vosges. In Scotland it grows at the height of 2700 feet on the Grampians; it is found at the height of 2300 feet on Ben-na-Buir, in Aberdeenshire; and at an equal height on the mountains near Loch-na-Gar. In all these situations it is found on soils dry, sandy, gravelly, granitic, or argillaceous, and least frequently on a calcareous soil. The magnificent pine forests of the Northern and Western Highlands of Scotland were resorted to for timber over a century ago, when the cost of wood began to increase; and in the words of Sir T. D. Lauder the forests were 'unmercifully slaughtered', in consequence of the enhanced price of Baltic timber during the wars of the latter part of the eighteenth and the early nineteenth century. In 1786 the Duke of Gordon sold his Glenmore Forest to an English company for £10,000. It was supposed to be the finest pine wood in Scotland. Many of the trees felled measured 18 feet and 20 feet in girth; and there is still preserved at Gordon Castle a plank nearly 6 feet in breadth, which was presented to the duke by the company.

The Labrador or Banks's Pine (*P. Banksiana*) is a low straggling tree in its native country, growing among barren rocks to a height of from 5 to 8 feet, but in British collections, in good soil, attaining three times that height. The cones are recurved and twisted; and the leaves are regularly distributed over the branches, instead of being collected in tufts alternating with naked spaces, as in most other pines, a distinction, therefore, by which this species is easily recognized. In Nova Scotia and the State of Maine it is known as the Scrub Pine, and in Canada as the Gray Pine. It is not common in English nurseries, although the plant appears to have been introduced into Britain fully a century ago. Loudon remarks that as an ornamental tree it is 'one of the most interesting of the genus, from the graceful manner in which it throws about its long, flexible, twisted branches, which are generally covered throughout their whole length with twisted glaucous green leaves, with here and there a whorl of curiously hooked horn-like cones.' It is one of the hardiest of the Abietines.

The Corsican Pine (*P. Laricio*) grows to a height of from 80 to 100 feet, and in the island of Corsica it is said to reach an altitude of 140 to 150 feet. The trunk and branches have a reddish-coloured bark, like that of the Scotch Pine. The leaves vary from 4 to 7 or 8 inches in length, and are dark coloured. The cones occur in clusters of two or more, pointing slightly downwards, are 2 or 3 inches long, and of a rusty yellow or tawny colour.

The Pinaster, or Cluster Pine (*P. pinaster*), is indigenous to the south of Europe, to the west of Asia, the Himalayas, and, it seems, even to China. It is a large, handsome, pyramidal tree, varying from 40 to 60 feet in height, and readily distinguished from other pines by its clustering masses of foliage, of a lighter green than the Corsican pine. Its cones point upwards, in star-like clusters, whence the name of Pinaster or Star Pine. It is of rapid growth, plants having in twenty years from the seed reached a height of 30 feet in the climate of London. In France it covers immense tracts of barren sand, in which it has been planted to prevent the sand from drifting. It yields resin and tar to the inhabitants of the Landes of Bordeaux, and between that city and Bayonne, where the pinaster forests are named *pinèdes*.

The Stone Pine (*P. pinea*) is a lofty tree in the

south of Europe, where it is a native; its spreading head forms a kind of parasol; the trunk is 50 or 60 feet high, and clear of branches; the bark is reddish, and smooth; the leaves are of a deep green, semicylindrical, 6 or 7 inches long, two in a sheath, and forming a triple spiral round the branches. The fruit ripens at the end of the third year, when the cones are about 4 inches long and 3 inches in diameter, having a reddish hue. Each scale is hollow at its base, and in its interior are two cavities, each containing a seed much larger than that of any other species of European pine. The ligneous shell enveloping the kernel is hard, but in the variety *P. p. fragilis* is tender and easily broken by the fingers. In both kinds the kernel is white, sweet, and agreeable to the taste. In Britain the Stone Pine seldom exceeds the size of a large bush, although specimens have reached a height of 30 and 40 feet. The kernels have been found among the domestic stores of Herкулaneum and Pompeii. The tree has been known in England for three centuries.

Sabine's Pine (*P. Sabiniana*) was discovered in California by David Douglas in 1826, and named after his early friend and patron Mr. Sabine. The leaves are in threes, rarely in fours, from 11 to 14 inches long; the trees are of a tapering form, straight, and from 40 to 120 feet high, with trunks from 3 to 12 feet in diameter. The cones measure from 6 to 8 inches round. This species is said to be as hardy in this country as the pinaster.

Coulter's Pine is variously described as a separate species and as a variety of Sabine's. It was found by Dr. Coulter growing on the mountains of Santa Lucia in lat. 36°, and at an elevation of 3000 to 4000 feet. The leaves are broader than those of any other pine, and the cones, which grow singly, are the largest of all, being often more than 1 foot long and 6 inches in diameter, and weighing about 4 lbs. In its general appearance the tree resembles Sabine's Pine, but is distinguished from it by the upright character of its foliage. Both species are hardy, and of surpassing beauty.

The Cembra Pine (*P. Cembra*) has its leaves in fives, three-ribbed; cones about 3 inches long; seed larger than that of any other species except the Stone Pine. The tree is a native of Switzerland and Siberia. In Britain it is an erect tree, with smooth trunk and whorls of branches. Lambert states that the flowers have a more beautiful appearance than those of any other species of pine. Although usually of slow growth, yet plants sown in the neighbourhood of Edinburgh were found to have attained a height of from 8 to 12 feet in eight years. The wood is soft and its grain extremely fine.

The Red Canadian Pine (*P. resinosa*), inhabits the whole of Canada from the Atlantic to the Pacific, and is also found in the northern and eastern parts of the United States. In Canada and Nova Scotia it is called Yellow Pine—it is sometimes also improperly termed Norway Pine. Even in those districts where most common it only occupies small tracts of a few hundred acres, where the soil is dry and sandy, and grows either alone or in company with the white pine. The trunk rises to the height of 70 or 80 feet by about 2 in diameter at the base, and is chiefly remarkable for its uniform size for two-thirds of its length: the bark is clear, red, and smooth; the leaves are in pairs, and are collected in bunches at the extremity of the branches; and the scales of the cones are unarined. The wood is compact, fine-grained, resinous, and durable. In the British provinces and in Maine it is frequently employed in naval architecture, especially for the decks of vessels, furnishing planks free from knots, of 40 feet in length. It is also used for masts, and has furnished the mainmast

of a 50-gun ship. It is exported to Britain both from Maine and from the St. Lawrence.

The true Yellow Pine of America (*P. variabilis*) rises to the height of 50 or 60 feet, by 15 or 18 inches in diameter at base, and sometimes more; the leaves are 4 or 5 inches long, and are usually in pairs, but sometimes in threes on the younger shoots; the cones are small, oval, and armed with fine spines. The timber is fine-grained, compact, and moderately resinous. Great quantities are used in shipbuilding at Philadelphia, Baltimore, and elsewhere, for decks, masts, yards, beams, &c.

The Jersey Pine (*P. inops*) has received this appellation from being most abundant in the lower part of New Jersey, where it grows in company with the yellow pine. This is a small straggling tree, rarely attaining the height of 30 or 40 feet, with a diameter of a foot at base. The leaves are in pairs, 1 or 2 inches long, and the cones 2 to 3 inches long, and armed with strong spines. The trunk is too small to be of any utility in the arts, and besides consists of a great proportion of sap.

The Pitch Pine (*P. rigida*) is most abundant along the Atlantic coast, where the soil is diversified, but generally meagre. The ridges of the Alleghenies in Pennsylvania and Virginia are in some parts covered with it. The 45th degree of latitude appears to be its northern limit. It is frequently seen in large and miry swamps, and in such situations attains the height of 70 or 80 feet by 2 in diameter at base; and it appears to support the presence of sea-water better than any other pine. The leaves are in threes, varying much in length, as do the cones in size; the latter are armed with acute spines. The branches are numerous, and occupy two-thirds of the trunk. The quality of the wood varies according to the situation; in swamps it is light, soft, and consists of a greater proportion of sap; but in a dry, gravelly soil it is compact, heavy, and contains much resin. The long-leaved pine is also called pitch pine.

The Loblolly Pine (*P. taeda*), another American tree, often exceeds 80 feet in height, with a wide-spreading summit. The leaves are 6 inches long, united by threes, or sometimes fours on the young and vigorous shoots. The cones are 4 inches long, and armed with strong spines. The timber decays speedily on being exposed to the air; hence this is to be regarded as one of the least valuable of the pines.

The Long-leaved Pine (*P. palustris*) abounds in the lower parts of the Carolinas, Georgia, and Florida. Not only does it furnish resin, tar, pitch, and turpentine, but the timber is very useful for a great variety of purposes, and, moreover, the tree grows only in a soil so sterile as to be incapable of being converted to any other use. It is known in commerce under a variety of names; in those districts where it grows it is called long-leaved pine, yellow pine, pitch pine, and broom pine; in Britain, simply pitch pine. It grows to the height of 60 or 70 feet, with a trunk 15 or 18 inches in diameter for two-thirds of this height. The cones are 7 or 8 inches long by 4 in diameter, are armed with small spines, and contain seeds of an agreeable flavour. The unusual length of the leaves, about 12 inches, gives this tree a peculiarly striking appearance. The trunk contains but little sap, and the concentric circles are close and at equal distances, while the resinous matter is abundant and equally distributed, which renders the wood stronger, more compact, and more durable than in the other species; it is, besides, fine-grained and susceptible of a brilliant polish, and is applied to a great variety of uses. That variety which acquires a reddish hue from growing in certain soils, and is known by the name of red pine, is most esteemed.

The Weymouth Pine, or White Pine (*P. strobus*),

is a lofty American tree, and its timber, though it has some defects and disadvantages, is consumed in considerable quantities for a very great variety of purposes. It attains the height of 150 feet or more, with a trunk 5 feet and upwards in diameter; the leaves are in fives, and the cones are 4 or 5 inches long, pendulous, with thin, smooth scales. Owing to the lightness and delicacy of the foliage the young trees make an elegant appearance. The wood has little strength, and is liable to swell from humidity in the atmosphere; but it is soft, light, free from knots, easily wrought, durable, furnishes boards of great width, and, above all, is still abundant and cheap. The tree is now common in Britain.

The Douglas Pine (or Fir), or the Oregon Pine, is *Pseudotsuga* (*Tsuga*, or *Abies*) *Douglasii*. It is found in western North America from British Columbia to Mexico, but the finest specimens occur in Washington and Oregon, where it forms extensive forests. It also thrives in Britain. Its wood is hard, strong, and durable, and finds extensive application, especially in the states above mentioned.

Lambert's Pine (*P. Lambertiana*) flourishes chiefly between the fortieth and forty-third parallels of latitude, and about 100 miles from the Pacific. The trunk is from 150 to upwards of 200 feet in height, and is from 7 to nearly 20 feet in diameter. It is straight, and destitute of branches for two-thirds of its height. The leaves are in fives, and the cones are pendulous at the extremities of the branches, and require two years to attain their full growth, when they are 14 to 16, and sometimes 18 inches, and nearly 4 inches in diameter at the thickest part. The timber is white, soft, and light, and produces abundance of a pure amber-coloured resin which, when the trees are partly burned, acquires a sweet taste, and in this state is used by the natives as a substitute for sugar. The seeds are eaten either roasted or pounded into coarse cakes for use during the winter season.

PINE-APPLE (*Ananassa sativa*), a plant belonging to the natural order Bromeliaceae, much esteemed for its fruit. It was originally found by the Europeans in Peru, and has not been known in Europe much above two centuries. It passed from Brazil to the West Indies, and thence was transported to the East Indies, where it has long been successfully cultivated. The leaves are canaliculate, and spiny on the margin; the stem erect and about 2 feet high; the flowers blue and united in a dense spike, which is crowned at the summit with a tuft of leaves; the fruit is formed by the union of numerous succulent ovaries and bracts. The seeds have been rendered abortive by cultivation. The pine-apple is most readily reproduced by planting the terminal tuft of leaves; but in our greenhouses it is far inferior to the tropical fruit, and yet is generally cultivated in many parts of Europe, especially near the larger cities. Many varieties of the pine-apple have been produced, but they may be referred to seven principal ones. Some of the other species of Bromeliaceae have crowns, and the fruit of most of them, though small, is eatable. The *Bromelia Penguin* has the fruit separately in clusters, and not in a cone, and the leaves afford a fibre which is manufactured into cordage, or sometimes into good cloth. A beautiful fibre is also yielded by the common pine-apple plant, which is employed for textile fabrics. (See PINE CLOTH.) From the pine-apple is made very good wine, which turns in about three weeks, but recovers by longer keeping. The fruit is also sometimes preserved entire, and when taken out of the syrup is iced with sugar.

PINE FINCH, or PINK GROSBEEK (*Pinicola*, or *Pyrrhula enucleator*), a genus of Conirostral Perching Birds or Insectores, belonging to the sub-family of the Bullfinches (*Pyrrhulinae*). It is of larger size

than the Common Bullfinch, and measures from 8 to 9 inches in length. The head, fore-parts, neck, and rump are coloured bright red. The back is a blackish brown, the feathers of this region having red edges, the lower portion of the body being of a light gray hue. The wings and tail are dusky, the wing-feathers being variously marked with white stripes and patches. The food consists of the delicate buds and leaves of plants and trees, the buds of the birch-willow being said to form its chief article of diet in its native haunts. As implied by its popular name this finch chiefly inhabits pine forests. It occurs in the Arctic and northern regions of both Old and New Worlds. It breeds in these northern portions, but in America appears to migrate southwards to the United States. It is more rarely found in the temperate portions of Europe. Its song notes are agreeable, and its flesh is esteemed in Russia, in which country it forms a marketable delicacy. Four or five eggs of a pale green colour spotted with brown are produced; the nest, roughly built of sticks and lined with feathers, being placed on a branch of a tree near the ground. Audubon says that these birds are exceedingly tame and tolerant of the human presence even in a wild state.

PINEL, PHILIPPE, member of the French Institute and of the Legion of Honour, the Howard of the insane, was born in 1745, at St. André, in the department of Tarn, studied at Toulouse and Montpellier, where he supported himself by teaching mathematics. In 1778 he went to Paris, and at first applied himself to the study of the sciences connected with medicine, but afterwards devoted himself entirely to that science itself. In 1791 he was made directing physician at the Bicêtre, an insane hospital, and in 1794 at the Salpêtrière. The harsh treatment of the insane then in vogue, their chains and unhealthy dungeons, filled him with horror. He introduced gentle treatment, uniting firmness with kindness, and was the first definitely to recommend moral remedies (in his work *Sur l'Aliénation mentale*), and one of the earliest to establish a regular system in the mad-houses. He also proved the existence of what he called *manie sans délire*. He placed less stress on physical treatment, and in particular he agreed with Borden in condemning blood-letting. In general he recommended delay. 'What art cannot effect,' he used to say, 'time may accomplish.' His pathology was founded on Condillac's system of philosophy, and was directed more to a consideration of the obvious phenomena than to a thorough insight into the nature of diseases; yet his *Nosographie philosophique* (Paris, 1798; sixth edition, 1818) formed an epoch in French medicine, as it supplied a want then generally felt. In many respects Pinel is to be considered as the precursor of Bichat, since he was the first to point out the physiological and pathological difference of the various tissues. He edited for some time the *Gazette de Santé*, and was a collaborator in Fourcroy's *Médecine éclairée par les Sciences physiques*, and in the great *Dictionnaire des Sciences médicales*. During the reign of terror Pinel concealed the unfortunate Condorcet in his house. In 1823, when the school of medicine was reformed by the government, M. Pinel was removed from his post on suspicion of entertaining liberal principles; and he died three years later, at the age of eighty-one years.

PINE-RESIN. The juice which exudes from pines, firs, and other coniferous trees contains a mixture of resins generally containing oxygen with volatile oils, and sometimes acid bodies. The resin *colophony* ($C_{10}H_{16}O_2$) is characteristic of these juices.

PINEROLO, a town, Kingdom of Italy, in the province of Turin, 21 miles south-west of the city of

that name, at the mouth of Val Clusone. It has several squares, one of them, the esplanade, forming a finely planted walk. The cathedral, a modern structure, possesses little merit; but one of the churches is of ancient Gothic; and there are in the town a town-house, episcopal seminary, college, and handsome barracks. The citadel of Pinerolo was at one time the prison of the Man with the Iron Mask. The manufactures are woollen and silk goods, iron-ware, firearms, vermicelli, liqueurs, and spirits. Pop. 12,003.

PINE WOOL, the name given to the fine fibres of the leaves of the pine-tree, when separated and dressed into a state in which they much resemble cotton. The preparation of this material is chiefly carried on in Silesia, Thuringia, and Sweden. It is used for making wadding, a coarse kind of blanket, stuffing cushions, mattresses, &c.

PINEY VARNISH, a name of gum anime or East India copal. See **COPAL**.

PINION, in mechanics, an arbour or spindle in the body of which are several notches, which catch the teeth of a wheel that serves to turn it round; or it is a lesser wheel that plays in the teeth of a larger one. See **WHEEL-WORK**.

PINK (*Dianthus*), a genus of plants belonging to the natural order Caryophyllaceæ. More than 100 species are known, all, with perhaps one or two exceptions, natives of the northern and temperate parts of the European continent. Their roots are annual or perennial; the stems herbaceous and jointed; the leaves opposite and entire, and the flowers terminal, aggregate, or solitary, and always beautiful. Many are common in gardens; and perhaps no plant is more highly esteemed by the florist than the carnation, both for its beauty and its rich spicy odour. Nearly 400 varieties are enumerated.

PINKERTON, JOHN, F.S.A., an eminent antiquary, was born at Edinburgh in 1758, and was articulated to a writer to the signet, in whose office he continued five years. In 1780 he went to London to devote himself solely to literature, where in 1781 he published an octavo volume of miscellaneous poetry, under the title of *Rimes*, with dissertations On the Oral Tradition of Poetry, and On the Tragic Ballad, &c. In 1783 he published his *Select Scottish Ballads* in two volumes. Among the pieces in these volumes were a number by Pinkerton himself, though at that time he represented them as genuine ancient productions. His *Essay on Medals* (1784, two vols. 8vo) went through three editions. In 1785 he published *Letters on Literature*, under the assumed name of Heron. In this publication he ventured upon a novel system of orthography, substituting *a* for *s* to indicate the plural. The work obtained him the acquaintance of Horace Walpole, after whose decease he published *Walpoliana*. Next year appeared *Ancient Scottish Poems*, from the Manuscript Collection of Sir Richard Maitland of Lethington, with Notes and a Glossary. These poems were by many believed to be forgeries by Pinkerton himself, but it is now well known that this was not the case. The Maitland MS. is contained in the Pepysian Collection at Cambridge. A *Dissertation on the Origin and Progress of the Scythians or Goths* appeared in 1787; in this work the author first obtruded that strong prejudice against the Highlanders which raised a host of enemies. In 1790 he published his *Inquiry into the History of Scotland* preceding the *Reign of Malcolm II. or 1056*. This work, notwithstanding that the author's absurd animosity to the Celtic race necessarily hindered him from being an impartial judge, is yet a most valuable one, and contains some rare and curious documents. It may be said to have been the first work which thoroughly

altered the great 'Pictish question,' the question whether the Picts were Goths or Celts. Pinkerton scouted the idea of their belonging to any other race than the Gothic. He characterizes the Celts as 'mere savages but one degree above brutes;' and remarks 'all we can do is to plant colonies among them, and by this and encouraging their emigration try to get rid of the breed.' His chief remaining works are the *Medallist History of England* (4to); *Scottish Poems*, reprinted from scarce editions (three vols.); *Iconographia Scotica* (two vols.); *History of Scotland from the Accession of the House of Stuart to that of Mary* (two vols.); *Modern Geography* (two vols. 4to); *General Collection of Voyages and Travels* (nineteen vols. 4to). He died at Paris, March 10, 1826.

PINNA, or **WING SHELL**, a genus of Lamellibranchiate Mollusca included in the family Aviculidae. The Pinnae possess wedge-shaped shells of a horny, delicate structure. The hinge is toothless. The umbones or beaks of the shell form a pointed extremity. The edges of the mantle are doubly fringed. The foot is long and grooved, and secretes a 'beard' of 'byssus' in great quantity and of strong, silky texture. The genus is represented by the *Pinna pectinata* of the British coasts, by the *P. nobilis* of the Mediterranean Sea, by the *P. bullata*, *P. rudis*, *P. nigra*, and by other species. The 'byssus,' like that of the mussel, is used to moor or attach the animal to rocks and fixed objects, and the *P. nobilis* in past days afforded sufficient material from its byssus for the Neapolitans, Sicilians, and Maltese to weave quantities of a durable silk fabric which was used in the manufacture of stockings and similar articles. By the ancients this byssus material was also used and highly valued, and frequent mention is made of the fabric by Latin authors. Pope Benedict XV. in 1754 had a pair of stockings presented to him which were made from the byssus of the Pinna. See the second plate at MOLLUSCA.

PINNACE, a small vessel used at sea, with a square stern, having sails and oars, and carrying three masts, chiefly employed to obtain intelligence and to land men, &c. One of the boats of a man-of-war, used to carry the officers to and from the shore, is also called the pinnace. It is smaller than the launch, but larger than the cutter, and is rowed by from ten to sixteen oars.

PINNACLE, in architecture, a small square or polygonal shaft, terminating upwards in the form of a pyramid, embellished with foliage at the angles of the pyramidal part. It is much employed in Gothic architecture as a termination to buttresses, the tops of gables, &c., in which cases it is in the form of a spire with crockets and a finial. The decorated pinnacles have often in their faces niches occupied with statues, and are highly ornamented.

PINNIGRADA. See CARNIVORA.

PINNIPEDIA. See CARNIVORA.

PINSK, a town of Western Russia, in the government of Minsk, and 148 miles s.w. of the city of that name, on the left bank of the Pripet, which here receives the Pina. The extensive marshes formerly surrounding it have now been drained. It has considerable manufactures of Russian leather, and an active transit trade is carried on by means of the Oghinaky Canal, which connects the Dnieper and the Black Sea with the Niemen and the Baltic. The trade consists chiefly in corn, salt, hemp seed, tar, tallow, iron, glass, tobacco, and timber, and is carried on mainly by Jews, who form about three-fourths of the population. In 1648 a great battle was fought here between the Cossacks and the Poles, during which 5000 houses were burned down, and 14,000 persons were killed. The town, which has never recovered its former prosperity, fell into the possession of Russia

at the second partition of Poland in 1793. Pop. (1897), 28,028.

PINT, a measure of capacity used for both liquids and dry goods; it is the eighth part of a gallon, or 34·65925 cubic inches. The Scotch pint, equivalent to 3·0065 imperial pints, though no longer a legal measure, is still in use.

PINTAIL DUCK, a genus of Anatidae or Ducks, so named from the elongated form of the tail-feathers. These ducks form the genus *Dafila*, the Common Pintail Duck being the *Dafila acuta* of the naturalist. The hinder toe, as in the true Ducks, is small and not attached to the other digits by the web or membrane which unites the front toes. The bill is destitute of a basal tubercle. The lamellae, or plate-like fringes of the bill, are narrow, and do not project. The tail in the males is long, and exhibits a pointed tapering conformation. In size the Pintails equal the Mallards, and are thus larger than the common ducks, the neck being elongated in proportion. The head in the Common Pintail Duck is coloured brown, a white streak extending from the head down the neck on each side. The general body colour is a grayish-white; the lower parts being white, and the central tail-feathers black. The Pintails chiefly inhabit the southern regions of the world, and are found principally in the vicinity of fresh-water lakes. These birds are found on the British coasts in summer, but migrate southwards in winter. They are common in the Mississippi Valley, and they occur on the Mediterranean coasts, in the Gulf of Mexico, in the West Indian Islands, and in Africa. The flight is rapid and noiseless. These ducks breed in confinement, and the flesh is savoury.

PINTURICCHIO, an eminent painter of the Roman school, whose real name was BERNARDINO BETTI, the disciple of Pietro Perugino, was born at Perugia in 1454. He painted chiefly in history and grotesque, but he also excelled in portraits. His chief work was the History of Pope Pius II., in ten compartments, in the library at Siena. Others consider his work in the cathedral of Spello his best performance. His style was effective, but he made use of too splendid colours, and introduced abundance of gilding. He is said to have died of chagrin at the following circumstance: Being engaged to paint a Nativity for the monastery of St. Francis at Siena, he pertinaciously insisted that everything should be removed out of the room in which he worked, and obliged the monks to remove a great chest become rotten from age. In the attempt it burst, and discovered a hoard of 500 pieces of gold, to the great joy of the fathers and the mortification of Pinturicchio. According to a more reliable account, he died of poison administered by his wife, on whose extravagant habits he attempted to put a check. His death took place in 1513.

PIOMBINO, a former principality of Tuscany, lying between Siena and the Mediterranean, opposite the Island of Elba, from which it is separated by the channel of Piombino. Its extent was about 216 square miles, with a population of 25,000 at the time of its incorporation with the Kingdom of Italy (1860). It was originally a fief in the possession of the Appiani family, which, after a rule extending over 800 years, sold it to the Buoncampagni family in 1634. In 1804 Napoleon granted it to his sister Eliza, princess Baciocchi; but by the Congress of Vienna she was rejected, and the old family restored. It now forms part of the province of Pisa.

PIOMBO, SEBASTIANO LUCIANO DEL, a celebrated painter, born at Venice in 1485. His family name was *Luciani*. Having renounced music, of which he was very fond, for painting, he studied at first under Giovanni Bellini, and afterwards under Giorgione,

whose fine colouring he imitated. Sebastiano commenced as a portrait-painter, and the reputation which he soon gained in that branch induced Agostino Chigi, a rich merchant of Siena, to take him to Rome and employ him in ornamenting his house. The delicacy of his pencil was much admired, and Michael Angelo, who seems to have been somewhat jealous of the growing fame of Raphael, encouraged him to enter into competition with that master, and even supplied him with designs, which Piombo often executed very happily, although by no means capable of lofty conceptions or sublime inventions. When Raphael had painted his celebrated Ascension, Sebastiano was induced by Michael Angelo to attempt to surpass it by the Raising of Lazarus, which is considered his greatest work. His Martyrdom of St. Agatha was also ranked among the pieces of the first masters. His chief merit, however, lay in single figures and portraits. His Pietro Aretino and his Clement VII. were admirable likenesses and specimens of perfect colouring. He was high in favour with Clement, who created him keeper of the Papal seals. From this circumstance he derived his surname *Del Piombo*, the seals attached to the Papal bulls being at that time of lead (*piombo*). This post made it necessary for him to assume the clerical habit, and from that time he painted but little. He wrote verses, entertained learned men at his table, and only occasionally painted a portrait. He died in 1547. It also deserves to be mentioned that he invented a peculiar method of painting in oil on walls, in which manner there is a Scourging of Christ to be seen in S. Pietro in Montorio.

PIONEERS, labourers attached to an army for the making and repairing of roads, and performing all labours connected therewith, digging trenches, and preserving cleanliness in the camp when stationary, &c. Originally these duties had to be performed by labourers in the country occupied by the army, but now such persons are only employed as auxiliaries, a number of men being attached to each corps as a permanent body of pioneers.

PIOTRKOV. See **PETRIKAV**.

PIOZZI, **HESTER LYNCH**, an English authoress, born on Jan. 16, 1741, near Pwllheli, was the daughter of John Salusbury of Carnarvonshire. Early in life she was distinguished in the fashionable world by her beauty and accomplishments. In 1763 she was married to Henry Thrale, a brewer of great opulence in Southwark, which borough he afterwards represented in Parliament. Soon after commenced her acquaintance with Dr. Johnson, who lived much with the Thrales over a period of sixteen years, and of whom she published *Anecdotes in one octavo volume* (1786). Mr. Thrale dying in 1781, his widow, who was the mother of five daughters, married in 1784 Mr. Piozzi, a Florentine music-master, then resident in Bath. This alliance annoyed her friends, and Johnson entirely gave up her society. She accompanied her husband to Florence, and while there contributed several poems to the *Florentine Miscellany*, founded by the leaders of the Della Cruscan school. Among her writings are—*Observations made in France, Italy, and Germany* (1789); *British Synonymy, or an Attempt at regulating the Choice of Words in Familiar Conversation* (1794); *Retrospection, or a Review of the most Striking Events and Characters of the last 1800 Years* (1801), &c. Mrs. Piozzi died at Clifton, May 2, 1821. Her *Autobiography, Letters, and Literary Remains* appeared in 1861.

PIP, or **PER**, a disease among poultry, consisting of a white thin skin or film that grows under the tip of the tongue, and hinders their feeding. It most frequently occurs in damp or very cold weather.

Its earliest symptoms are a slight hoarseness and catching in the breath, followed by an offensive discharge from the eyes and nostrils, rattling in the throat, and finally the accumulation of mucus in the mouth. The disease rapidly spreads over a whole poultry-yard, probably owing to the contamination of the water in a common drinking vessel. The diseased birds must be kept warm; some authorities recommend the administration of castor-oil, and also a mixture of $\frac{1}{2}$ drachm of dried sulphate of iron and 1 drachm of capsicum, made up into thirty pills with extract of liquorice; one pill to be given three times a day. After a certain time for this is substituted a compound of sulphate of iron, cayenne pepper, and butter. Others recommend that the fowls should be fed on oatmeal mixed with ale, along with a liberal supply of green food. As the birds recover, the scale on the tongue will disappear. The eyes, nostrils, and mouth may be washed with vinegar.

PIPA, a genus of Amphibians, popularly designated 'Surinam Toads', and forming the type of a distinct family (Pipidae) of the Amphibian order Anoura. The best-known species is the *Pipa Americana* of Surinam and Brazil. The tongue is absent throughout this family, and teeth are but rarely developed. In the genus *Pipa* teeth are totally wanting, but in an allied genus (*Dactylethra*) the upper jaw is provided with minute teeth. The head in the *Pipas* is of triangular form, the eyes being placed close to the mouth. The body is broad, the hind-legs long and powerful, the toes of these legs being fully webbed. The tympanum of the ear is concealed. *Dactylethra capensis*, found in South Africa, differs from all other Amphibia (except one of the Salamanders) in possessing nails on the three inner toes of the hind limbs. The Surinam Toad, which is shown on the plate at AMPHIBIA, is one of the most repulsive-looking of the Toads, and it is noted as exemplifying, in the case of the female animals, an anomalous mode of developing the eggs and young. A number of pits or depressions termed 'dorsal cells' appear to be formed on the back of the female *Pipas* at the breeding season. In each cell an egg is deposited, the eggs being first deposited by the female in water after the usual method, and being impregnated by the male, who then collects the eggs and places them in the female's back. Each cell appears to be closed by a lid-like fold, and within the cells the development and metamorphosis of the young take place, these new forms emerging from the parental cells in the adult and mature form. It was formerly imagined that the eggs were not only contained as described, but also developed within the dorsal cells of the females; but a closer study of the phenomena showed that the eggs were produced and extruded from the reproductive organs as in other Amphibia, and were placed in the cells by the males as already stated. About eighty-two days is stated as the period required for the full metamorphosis and development of the young within the maternal cells. Notwithstanding the repulsive appearance of the *Pipas* they are said to be eaten and regarded as delicacies by the natives of Guiana.

PIPE, a wine measure, usually containing very nearly 105 imperial or 126 wine gallons. Two pipes or 210 imperial gallons make a tun. In practice, however, the size of the pipe varies according to the kind of wine it contains. Thus, a pipe of port contains 138 wine-gallons; of sherry, 130; of Madeira, 110, &c. The pipe of port is seldom accurately 138 gallons, and it is customary to charge what the vessel actually contains.

PIPE, a tube for the conveyance of water, steam, gas, or other fluid, used for a great variety of purposes in the arts and in domestic economy. The

materials of which pipes are made are also very various, wood, stone, earthenware, iron, lead, copper, leather, gutta-percha, &c., being all employed. For many years London was supplied with water by pipes made of elm logs bored through the centre by auger, and fitted together by means of the conical termination at one end entering into the corresponding enlarged cavity of the next length. Pipes of this kind are still used to some extent in countries where wood is plentiful, but they are very defective from the rapid decay they undergo when laid down; and iron or earthenware pipes are being gradually substituted. Drainage and sewerage pipes of great strength and size (measuring from 1 or 2 up to 54 inches in diameter) are now usually made of fire-clay, glazed on their outer and inner surfaces. There is a socket at one end to receive the end of the next. Earthenware pipes are made by squeezing a continuous length of plastic clay through a circular orifice, the centre of which is occupied by a mandril of the size of the interior of the pipe. Large iron pipes are usually cast, and are used for the supply of water and gas in the important towns of Great Britain and many foreign states. A great proportion of the manufacture of cast-iron pipes is carried on in Scotland. Small pipes of wrought-iron, brass, or copper, are made by rolling out narrow strips of metal, and then passing them through pairs of rollers, the one of which has a series of projecting beads round it, the other being furnished with corresponding grooves. By this means the edges of the metal strip are turned up. A mandril is then laid in it, and it is passed through a pair of concave rollers, which bring the edges together, thus forming a complete tube. The edges then require soldering. An improved method of producing small metal tubes has now, however, come into general use, and been brought to great perfection. A long cylinder of brass, copper, or tin is cast with a hole down the centre, of the same diameter as the desired bore of the pipe. The cylinder is conical at one end like a pencil. An accurately-fitting mandril is inserted in the hole, and made to project a little at the conical end; it is then brought to the drawing bench, where the tapered end is placed in a funnel-shaped hole drilled in a steel post. The point of the cylinder with the projecting mandril passes through this hole just sufficiently far to be gripped by a pair of pincers attached to a strong chain. Machine-power is then applied to the chain, and the metal and mandril are drawn through the hole. By this means the metal is extended equally over the surface of the mandril, which is then withdrawn, and the tube is complete, or it may require to be drawn through several holes gradually decreasing in size. This method has also been successfully adapted to the manufacture of pipes from steel. Lead pipes of almost any length and diameter can be made by a similar process to that adopted for earthenware tubes. The soft metal is pressed through a hole in a steel plate in which there is a fixed mandril, which forms the bore of the pipe.

PIPE, TOBACCO, a bowl and connecting tube, made of baked clay, wood, stone, or other material, and used in smoking tobacco. The cheap pipes in common use throughout Great Britain are made of a fine-grained white plastic clay, found chiefly in the Isle of Purbeck in Dorsetshire, and at Newton Abbot in Devonshire. This clay is worked with water into a thin paste, which is allowed to settle in pits, or it may be passed through a sieve to remove all stony impurities. The water is afterwards evaporated till the clay becomes a doughy-like mass, when it is well kneaded to give it uniform consistence. A child takes a small piece of this clay, rolls it with the palms of his hands upon a plank into a slender cylin-

der, which forms the stem of the pipe. To the end of this cylinder he fixes a lump of clay large enough to form the head or bowl. These rudimentary pipes are arranged by dozens on a board, and set aside for a day or two to gain more consistence. They are then handed to the pipe-maker, who pushes an oiled iron wire along the centre of the stem, so as to form the bore. The bowl is shaped by a folding brass mould channelled inside, each piece being hollowed out like a half pipe cut as it were lengthwise. The pipe is laid in one of the jaws of the mould with the wire still sticking in it; the other jaw is then brought down upon it, and held with a clamp. A lever presses an oiled stopper into the bowl of the pipe while still in the mould sufficiently far to form the cavity, the wire being kept working backwards and forwards along the whole length of the tube to keep it open. The wire is then withdrawn, the mould opened, and the pipe taken out, and the redundant clay is removed with a knife. After drying for a day or two the pipes are scraped, polished with a piece of hard wood, and the stems being bent into the desired form, they are removed to the baking kiln or seggar. This consists of an inner circular chamber with a number of small stages, on which the pipes are arranged with their bowls resting against the circumference, their stems being supported on circular pieces of clay set up in the centre of the chamber for that purpose. The seggar is inclosed within a furnace of ordinary brick-work lined with fire-bricks. Between this and the cylinder there is left a space of about 4 inches all round for the passage of the flame. The inner chamber can be closed so as to exclude all smoke, and with a moderate fire and skilful packing, as many as 50 gross of pipes may be baked in eight or nine hours. When thoroughly baked they receive another polishing, and are then ready for the market. A clay pipe should not be too hard baked, should have a moderately long and slightly bent stem, an almost conical-shaped bowl, not rising from the stem at an acute angle; both stem and bowl should also be of moderate thickness. A pipe made on this principle will allow free passage to the smoke, will absorb the oil produced in smoking, and will not so readily get hot and bitter as a hard, short, and slender-stemmed pipe. All pipes coated with so-called meerschaum and other washes should be avoided, as these help to destroy the porosity of the clay. Much finer and more expensive pipes are made of meerschaum, a somewhat plastic magnesian stone of a soft greasy feel. This material is found in several parts of Europe (in Moravia, Piedmont, and the Crimea), but more abundantly and of finer quality in Asia Minor. Meerschaum pipe making is carried on to the greatest extent by the Germans, and Vienna may be said to be the centre of the manufacture. Sometimes the bowl alone (which is frequently artistically carved) is of meerschaum, the stem being of wood, the best sorts of which are got from the young stems of the Mahaleb cherry, grown near Vienna, the mock orange of Hungary, and the jessamine sticks of Turkey. The stem, whether of the same material as the bowl or of wood, is usually provided with a mouth-piece of ivory, silver, or amber, the last being preferred. Meerschaum pipes of the best workmanship have been known frequently to command the price of 100 guineas. Briar-root pipes, with the bowl and stem of one piece of wood, and provided with amber, ivory, or bone mouth-pieces, are now very common; they have little or no advantage over the clay pipe except in being less liable to break. Many Germans and Dutchmen prefer pipes with porcelain bowls, which are sometimes beautifully painted in the style of fine chinaware painting. The eastern hookah is a pipe of great size, the bowl of which is set upon

an air-tight vessel partially filled with water, and has a small tube which passes down into the water; the long flexible smoking-tube is inserted in the side of the vessel. By exhausting the air in the smoking-tube, the smoke is forced down through the water, and entering into the space above it passes into the stem, cooled and freed from some of the most acrid properties of the tobacco. Upon the American continent pipes have been in use from a very remote period. Indian pipes, with elaborately-carved soap-stone bowls and ornamented wooden stems, or entirely of baked clay, have been found in the ancient mounds of the West, together with other relics of an unknown race. See CALUMET.

PIPE-CLAY. See CLAY and PIPE (TOBACCO).

PIPE-FISHES (*Syngnathus*), a genus of fishes included in the sub-order Lophobranchii (which see) of the Teleostean order, and nearly allied to the genus *Hippocampus*, represented by the curious little fishes popularly known as 'sea-horses' (which see). As in all Lophobranchii ('tuft-gilled') the jaws of the pipe-fishes are of complete and free structure; the gills being disposed in tufts on the branchial arches, the gill-cover being large and the gill-aperture of small size. The body is covered by scales of the ganoid variety set lengthwise, and in the pipe-fishes is very long and tapering, and of attenuated, slender shape. No ventral fins exist, and the jaws are united to form a pipe or tube, bearing the mouth at the tip. The *Syngnathus acus* is the most familiar British species. It averages 20 inches in length. The snout is nearly cylindrical, and the mouth is destitute of teeth. The colour is yellowish, mottled with brown. The food consists of crustaceans, worms, molluscs, &c. The largest of the British species is said to attain a length of 3 feet. Other species are the *S. typhle*, *S. equoreus*, *S. ophidion*, *S. anguineus*, and *S. lumbriciformis*.

A very curious and remarkable circumstance in connection with the pipe-fishes consists in the males of some species possessing a pouch-like fold, situated at the base of the tail, in which the eggs are contained after being extruded from the body of the females. And after the young fry are hatched they appear to continue to reside within this pouch for a longer or shorter period, thus forcibly reminding one of the analogous arrangement seen in the kangaroos and other marsupial Mammalia. It has also been stated that if the young be shaken out of the pouch into the water, they will return into it on the body of the parent being held in the water so as to allow them to enter. The eggs, it is believed, are extruded into the pouch of the males by the females—the latter possessing no analogous structure. Yarrell states that from repeated dissections he has found that the pouch-bearing pipe-fishes were invariably males; those destitute of pouches being females, possessing ovaries containing eggs. The males of other fishes (for example, sticklebacks) are well known to assist or to perform the chief part of the incubatory duties; whilst it is also remarkable that in the Hippocampidae, near relations of the Pipe-fishes, the males also possess a pouch similarly situated to that of the Pipe-fishes, and used similarly for the deposition of the eggs and care of the young. The lining membrane of this pouch in the 'sea-horses' has also been alleged to furnish a fluid destined for the nutrition of the young.

The name Pipe-fish may also be applied to the members of the genus *Fistularia*, included in the Acanthopterus division of the Teleostei. The bones of the face are prolonged to form a tubular structure, at the extremity of which the mouth opens. The *Fistularia tabacaria* of the Antilles, averaging about 3 feet in length, represents this genus.

PIPERACEÆ, a natural order of shrubby or herbaceous exogenous plants, inhabiting the hottest parts of the globe, particularly India and South America. They have articulated stems, leaves opposite (sometimes alternate by abortion of one of the pair of leaves) or verticillate, exstipulate or stipulate, and spiked or racemose flowers. The flowers are hermaphrodite, and supported on a bract. Stamens 2-3-6, arranged on one side or all round the ovary; anthers one or two celled. Ovary solitary, free, one-celled. The wood is often arranged in wedges, with medullary rays, but without concentric zones. There are twenty-one known genera and above 600 species. The plants of this order have pungent, acrid, and aromatic properties. Most of them contain an acrid resin and a crystalline principle called piperine (see PIPERINE). Some are narcotic and astringent. The dried fruting spikes of *Piper longum*, an Indian creeper, are the long-pepper of commerce. Of late, however, the genus *Piper* has been subdivided, and this kind of pepper has been referred to various species of a new genus, *Charica*, namely, *C. peepuloides*, *Rosburghii*, and *officinarium*. The dried unripe fruits of *Piper nigrum* constitute black pepper. (See PEPPER.) The fruit of *Cubeba officinalis* (*Piper Cubeba*), a climbing plant of Java and other Indian islands, is the Cubeb pepper used extensively in arresting discharges from mucous membranes. (See CUBEBA.) The leaves and unripe fruit of *Piper angustifolium* constitute the aromatic, fragrant, and astringent substance called *malico* or *malica*, which has been recommended for checking hemorrhage. The leaves of *Piper Betel* (*Charica Belle*) are chewed in the East as a means of intoxication. (See BETEL.) The root of *Macropiper methyaticum* is the kava of the South Sea Islanders, and is used in the preparation of a stimulating beverage.

PIPERIC ACID, PIPERIDINE, and PIPERONAL. These names are given to three substances obtained indirectly from pepper. When piperine (which see) is boiled with caustic potash and alcohol potassium piperate is produced, from which piperic acid may be obtained by the action of hydrochloric acid. This acid has the formula $C_{12}H_{16}O_4$; it forms yellowish needles, which are nearly insoluble in water. By oxidizing the foregoing acid in neutral solution with potassium permanganate, colourless, transparent, long, lustrous prisms of piperonal are obtained. This body is the aldehyde of piperic acid; it has the formula $C_8H_8O_2$. If piperine be heated with soda lime a volatile base is obtained in the form of a colourless, mobile liquid, with an ammoniacal odour and a caustic taste; to this body, which is represented by the formula $C_8H_{11}N$, the name of piperidine is given.

PIPERINE ($C_{17}H_{19}NO_3$), an alkaloid contained in pepper, from which it is prepared by exhaustion with alcohol, &c. Piperine is a crystalline, colourless substance, insoluble in water, but dissolved by hot alcohol; the alcoholic solution has a very hot taste. Piperine unites with several acids to form well-defined salts.

PIPISTRELLE (*Vespertilio Pipistrella*), a genus of bats included in the family of the Vespertilionidae or True Bats, and in the Insectivorous section of the Chiroptera or Bat Order. The Pipistrelle is the familiar little bat which occurs throughout Britain, and flits about during twilight. It is also said to occur in Africa and India. It is of small size, and possesses a mouse-like body covered with hair, from which resemblance its popular name of Flitter-mouse has been derived. It feeds upon insects of various kinds, which it pursues on the wing; but it is also partial to meat, and has been found in larders and pantries feeding upon joints. The Pipistrelle inhabits the crevices of walls and old buildings through-

out the day. It passes the winter, like most other bats, in a state of torpidity; but appears to hibernate for a shorter period than other and larger species. The molar teeth are provided with sharp cusps, as in Insectivorous forms generally. The nose has no leaf-like appendages. The wing membrane or patagium (which see) measures about 6 inches in expanse. See illustration at CHEIROPTERA.

PIPET, or TITLARK (*Anthus*), a genus of Perching-birds, possessing also striking affinities with the true (Conirostral) Larks, which they resemble chiefly in the large size of the hinder claw, and the development of the tertiary quills. Most commonly, however, the Pipits are made to form a genus of Dentirostral Perchers, and thus belong to the sub-family of the Motacilline or Wagtails, which they closely resemble in their habits of running swiftly on the ground. Their food consists chiefly of insects. The bill is of moderate length, and slender, with the tip of the upper mandible notched and curved. The wings are long and pointed, the tertiary feathers being of great length. The tail is also elongated. The Meadow Pipit or Titlark (*Anthus pratensis*) is the commonest British species. The Shore Pipit, or Rock Lark (*A. petrosus*, not to be confounded with the American Shore Lark, one of the true Larks), frequents the sea-beach, and feeds on molluscs and Crustacea. The Tree Pipit or Titlark (*Anthus arboreus*) has a shorter curved hinder claw than the others. It is a summer visitant only in the British Isles. All the Pipits build their nests on the ground. The song in all consists of a clear, simple note, that of the Tree Pipit being imitated by the words *pit-pit*. See also LARK.

PIPPIN, the name given to a certain class of dessert apples, probably because the trees were raised from the pips or seeds, and bore the apples which gave them celebrity without grafting. They seem to have been introduced into Great Britain from France, and were little known there until about the end of the sixteenth century. In the time of Shakspeare pippins were delicacies for the dessert: Sir Hugh Evans, in the Merry Wives of Windsor, says, 'I will make an end of my dinner—there's pippins and cheese to come.' Justice Shallow, in his invitation to Falstaff, says, 'You shall see mine orchard, where, in an arbour, we will eat a last year's pippin of my own grafting.' The Ribston, Golden, Newton, and the small Scotch Oslin or Arbroath Pippin are favourite varieties.

PIQUET, a game at cards played between two persons with thirty-two cards, all the plain cards below seven being thrown aside. On the cards being shuffled the players cut for deal; the party drawing the lowest card has to deal first. The cards are then dealt two by two until each player has twelve cards, the eight remaining undealt (called the stock) are laid on the table between the players. The first hand (the non-dealer) must then discard five or less of his cards (he must discard at least one), exchanging them for an equal number drawn from the stock; the younger hand (the dealer) may exchange from the stock three or less, but may refuse to exchange altogether. In playing, the cards rank in order as follows: the ace (which counts eleven), the king, queen, and knave (each of which counts ten), and the plain cards, each of which counts according to the number of its pips. The player who first reaches 100 has the game. The score is made up by reckoning in the following manner:—Carte blanche, the point, the sequence, the quatorze, the cards, and the capot. Carte blanche is a hand of twelve plain cards, and counts ten for the player who holds it. The point is the suit of highest value, the value being determined by the number it makes up when the cards held are

added together; thus, if a player holds ace, king, ten, nine, and eight, his point would be forty-eight. The first player having called a point, the younger hand must then say whether his point is superior, equal, or inferior in value to his opponent's, by calling in the first place 'good,' in the second 'equal,' and in the last 'not good.' If the elder hand's point is 'good' he at once shows it, and counts one for each card in it, except with the points thirty-four, forty-four, fifty-four, and sixty-four, which count one less than the number of cards. If the points are equal he counts nothing. The sequence is composed of a regular succession of cards in one suit, and the highest sequence (that containing the greatest number of cards, or if the hands are equal that of the two which begins with the highest card), if of three cards, counts three; of four, counts four; of five, counts fifteen; of six, counts sixteen; of seven, seventeen; and of eight, eighteen. The quatorze is composed of four aces, four kings, four queens, four knaves or four tens, and counts fourteen. Should there not be a quatorze in either hand, the highest series of three or two is counted, but it adds only three to the holder's score. The holder of the highest sequence, quatorze, or trio counts all his inferior sequences, quatorzes, or trios, while those of his opponent do not count. The hands are played as follows:—After the elder hand counts his points he lays a card; the younger hand must lay a card of the same suit if he has it, but may lay any card in it he chooses. The highest card in the suit takes the trick. The winner of the trick has next lead, and the hands are played out as in whist. Each player for every card he leads above a nine counts one, and the second player also counts one for every card above a nine with which he wins a trick. The winner of the last trick counts two for it if gained by a card above a nine, and one if with one below it. The winner of the greatest number of tricks counts ten in addition (the 'cards'), if he holds all the tricks he counts forty in addition (the 'capot'). If a player scores twenty-nine in hand and one for the card he leads, before his opponent counts anything, he at once adds thirty to his score; this is called 'pique.' Should a player score thirty by the cards in his hand, by scores that reckon in order before his adversary can count, he obtains the 'repique,' which enables him to add sixty to his score. For the sake of convenience the scores are generally recorded at the end of the hand; but they are recordable no matter by which hand they are made, according to the following table of precedence: 1, carte blanche; 2, point; 3, sequences; 4, quatorzes and trios; 5, points made in play; and 6, the cards. If one player scores a hundred before the other obtains fifty he wins a double.

PIQUÉ-WORK, a fine kind of inlaid work, resembling Buhl-work (which see), but much more expensive and elaborate, the inlay being minute pieces of gold, silver, and other costly materials. It is confined to articles of small size, such as card-cases, snuff-boxes, &c.

PIRACY is the crime of robbery and depredation committed upon the high seas. It is an offence against the universal law of society, a pirate being, according to Sir Edward Coke, *hostis humani generis*. As, therefore, he has renounced all the benefits of society and government, and has reduced himself to the savage state of nature, by declaring war against all mankind, all mankind must declare war against him; so that every community has a right, by the rule of self-defence, to inflict that punishment upon him which every individual would, in a state of nature, otherwise have been entitled to do for any invasion of his person or personal property. By various statutes in England and the United States of America

other offences are made piracy. Thus, if a subject of either of these nations commits any act of hostility against a fellow-subject on the high seas, under colour of a commission from any foreign power, this is an act of piracy. So, if any captain of any vessel, or mariner, run away with the vessel, or the goods, or yield them up to a pirate voluntarily, or if any seaman lay violent hands on his commander, to hinder him from fighting in defence of the ship or goods committed to his charge, or make a revolt in the ship, these offences are acts of piracy by the laws of England. By the statute of 8 George I. cap. xxiv. the trading or corresponding with known pirates, or the forcibly boarding any merchant vessel (though without seizing her or carrying her off), and destroying any of the goods on board, are declared to be acts of piracy; and by the statute 18 George II. cap. xxx. any natural born subject or denizen who, in time of war, shall commit any hostilities at sea against any of his fellow-subjects, or shall assist an enemy on that element, is liable to be punished as a pirate. By statute of George II. cap. xxv. the ransoming of any neutral vessel, which has been taken as a prize, by the commander of a private ship of war, is declared to be piracy. By the act of Parliament, passed in 1824, the slave-trade is also declared to be piracy. In the time of Richard I., by the laws of Oleron, all infidels were regarded as pirates, and their property was liable to seizure wherever found. By the law of nations the taking of goods by piracy does not divest the actual owner of the property. Piracy, with intent to murder, stab, or wound, is capital, and pirates can gain no rights by conquest. It is of no importance, for the purpose of giving jurisdiction in cases of piracy, on whom or where a piratical offence is committed. A pirate, who is one by the law of nations, may be tried and punished in any country where he may be found; for he is reputed to be out of the protection of all laws. But if the statute of any government declares an offence, committed on board one of their own vessels, to be piracy, such an offence will be punished exclusively by the nation which passes the statute. In England the offence was formerly cognizable only by the admiralty courts, which proceeded without a jury, in a method founded upon the civil law. By the statute 28 Henry VIII. cap. xv. it was enacted that piracy should be tried by commissioners nominated by the lord-chancellor, but this mode of trial was altered by several statutes, more especially by 4 and 5 William IV. cap. xxxvi. and 7 and 8 Vict. cap. ii. The latter enacts that any justices of assize, or oyer and terminer, or jail delivery, may try piracy.

Piracy, in the common sense of the word, is distinguished from privateering by the circumstance that the pirate sails without any commission, and under no national flag, and attacks the subjects of all nations alike; the privateer acts under a commission from a belligerent power, which authorizes him to attack, plunder, and destroy the vessels which he may encounter belonging to the hostile state. He is not regarded as a pirate by the laws of nations, but in accordance with these is bound to observe certain rules and restrictions. Thus, he is debarred from attacking the vessels of the enemy while lying in any port or haven under the protection of a friendly or neutral state. See article *PRIVATEER*.

PIRÆUS (Greek, *Peiræus*), the principal port of both ancient and modern Athens, is situated about 5 miles from the city, on a peninsula projecting into the Gulf of Ægina. It has three harbours; two on the east side, anciently named respectively *Zea* (now *Stratitiki*) and *Munychia* (now *Phanari*), and one on the west side, called simply *Piræus*, or the *Harbour*. This harbour, the largest of the three,

was anciently divided into two parts, the one appropriated to war-ships, and the other occupied by merchant vessels. Previous to the Persian war the principal Athenian port was *Phalerum*, which was not situated on the *Piræan* peninsula at all, but lay to the east of *Munychia*; but *Themistocles*, seeing the natural advantages of the *Piræus*, surrounded the peninsula with a line of fortifications. The celebrated *Long Walls* which connected the port with the capital, were begun under the administration of *Pericles* in 457 B.C., and finished in 431. They were destroyed by the Spartans at the end of the *Peloponnesian* war, were rebuilt by *Conon*, and in later years were allowed to fall into decay. The ancient town possessed a considerable population, and many noble public and private buildings. The modern town, which is connected with Athens by a carriage road and a railway, and which has risen up since 1834, contains many warehouses, mills, and industrial works, but has few attractions. The port has great depth of water, and is capable of accommodating a large number of vessels. Pop. (1896), 42,169.

PIRANESI, **GIOVANNI BATTISTA**, a celebrated architect, engraver, and antiquary, was born at Venice in 1720. He passed the greater part of his life at Rome, where he died in 1778. His earliest work, published in 1743, consists of designs of his own, in a grand style, and is adorned with views of Rome. His other works include *Antichità Romane*, or *Roman Antiquities* (four vols. folio, 1756); *Antichità d'Albano e di Castel Gandolfo*; *Trofei d'Ottaviano Augusto*; *Della Magnificenza ed Architettura de' Romani*; and about 130 views of modern Rome. His architectural designs display much grandeur and fertility; but his representations of real objects are not always faithful. His own works extend to about twenty volumes, and his son and pupil *Francesco* continued the publication of works on similar lines. The collective Paris edition of 1835-37 is in twenty-nine volumes, with upwards of 1300 plates.

PIRANO, an Austrian seaport, in Istria, on a peninsula in the bay of *Largone*, 13 miles south-west of Trieste. It has narrow streets, an old dilapidated castle, a town-hall, a municipal library, a military hospital, a sea-bathing establishment, and a shallow harbour, admitting coasters only, though there is good anchorage for the largest vessels in the well-sheltered roadstead. The principal objects of commerce are wine and olive-oil. Pop. (1890), 12,328.

PIRITHOUS, in Greek mythology, son of *Zeus* and *Dia*, wife of *Lixion*, was king of the *Lapithæ*, and a friend of *Theseus*. He married *Dejanira* or *Hippodamia*, daughter of *Atrax*, a prince of the *Lapithæ*, by whom he had *Polypoetes*. His marriage is famous for the battle of the *Lapithæ* and *Centauræ*, occasioned by the attempt of a drunken *Centaur* (*Eurythion*) to do violence to the bride, and which resulted in the expulsion of the *Centauræ* from *Pelion*. After the death of his wife *Pirithous* went to *Athens*, and with *Theseus*, who had also lost his wife, carried off *Helen* from *Sparta*. Having reached *Athens*, they cast lots for her, on condition that he who was successful should aid the other in procuring a wife. She fell to *Theseus*, whom *Pirithous* required to aid him in the rape of *Proserpine*, wife of *Pluto*. The two friends, therefore, descended into the infernal regions, but having sat down to rest, they were unable to rise again. *Theseus* was afterwards set free by *Hercules*, but *Pirithous* remained in the infernal world loaded with 300 chains, or, according to some, was torn in pieces by *Cerberus*.

PIRMASENS, a town of Bavaria, in the *Palatinate*, in a mountainous district, 22 miles W.S.W. of *Landau*. It is well built, has a good town-house,

several churches, a synagogue, and manufactures of shoes, musical instruments, leather, machinery, &c. Pop. (1900), 30,194.

PIRNA, a town of Saxony, circle of Dresden, and 10 miles from the city of that name, on the right bank of the Elbe, at the confluence of the Gottlenba. It has fine promenades on the site of the fortifications that used to surround it; two Protestant churches, one of them a fine Gothic structure of 1502-46, restored in 1890; a new Roman Catholic church; an old town-house; manufactures of glass, enamelled ware, cigars, essences, &c.; and a considerable trade on the Elbe, especially in sandstone and grain. A little above the town, on a lofty rock, stands the castle of Sonnenstein, originally a fortress and state prison, and now converted into a lunatic asylum. Pop. (1895), 15,672.

PIRON, ALEXIS, a celebrated French wit, poet, and dramatist, born at Dijon on July 9, 1689, was the son of an apothecary. He took his degrees in the faculty of law at Besançon, and was about to be admitted to practice, when his parents experienced a reverse of fortune, which obliged him to relinquish his design. He remained some time at Dijon, leading a life of dissipation. At length he became clerk to a financier, whom he quitted to go to Paris, where he was employed as a copyist. This irksome situation he soon relinquished, and he was next engaged to write for the Theatre of the Comic Opera. After writing several pieces, he produced in 1738 his *chef-d'œuvre*, *Métromanie*, a comedy which Laharpe characterizes as excelling in plot, style, humour, and vivacity almost every other composition of the kind. Piron afterwards wrote *Fernand Cortes*, a tragic drama, and some other pieces, which obtained some success. In the latter part of his life he made repeated attempts to gain admission into the French Academy; but Louis XV. was induced by a mean intrigue got up by several disappointed authors to withhold his sanction to the election, and Piron was finally rejected. He revenged himself for his disappointment by calling the Academy *Les invalides du bel esprit*, and composing the humorous epitaph,

'Ci-gît Piron, qui ne fut rien,
Pas même académicien'.

Here lies Piron, who was nothing—
Not even an Academician.

His death took place January 21, 1773. Shortly before his death he became blind and deeply penitent, which did not, however, prevent the incessant flow of *bons mots* and epigrams. Almost the last act of his life was the composition of three epigrams in answer to those which Voltaire (his rival in this department of literature) would be likely to make on him on the news of his death. His *bons mots* were collected and published in one volume 18mo; and his *Poésies Diverses* were printed at Neuchâtel, 1775 and 1793, 8vo. His works entire form seven volumes octavo, in the edition of Rigolet de Juvigny, 1776. Troubat published *Euvres Choies* de Piron in 1890.

PISA (the ancient *Pisæ*), a town of Northern Italy, capital of the province of the same name, situated 6 miles from the sea and 44 miles west of Florence, on the railway thence to Leghorn, on both banks of the Arno, here crossed by three stone bridges for general traffic, and one carrying the railway. It is surrounded by walls and ditches, defended by a citadel, entered by five gates, and forms a circuit of nearly 6 miles, much of the space inclosed being unoccupied. The river is lined by handsome quays; the streets, though not straight, are spacious and well paved; and the houses are always substantial, often elegant, and remarkable for the profusion with

which marble has been employed in their construction. The chief squares are the Piazza del Duomo, the Piazza dei Cavalieri, the Piazza di Santa Caterina, and the Piazza San Niccolò. One of the most remarkable edifices of Pisa is the Duomo or Cathedral, begun in 1063, consecrated in 1118, one of the noblest ecclesiastical structures of Italy, built of white marble, in the form of a Latin Cross, surmounted by a lofty elliptical dome, supported by seventy-four pillars. The paintings, sculptures, and mosaics in the interior are the work of the greatest artists of the fifteenth to the eighteenth centuries. The Baptistery begun in 1153 by Diotisalvi, finished in 1278, is an immense rotunda, adorned with numerous columns and sculptures, and crowned by a noble dome, the top of which is 190 feet from the ground. The Campanile Pendente, or 'Leaning Tower', is of a circular shape, built of white marble, and fronted with 207 columns; its height is 179 feet, and it deviates 13 feet from the perpendicular. The question whether this peculiarity was designed or accidental still remains an open one. The probable solution is that the foundations settled during the progress of the structure, and that to remedy this defect an attempt was made to give a vertical position to the upper part. The Tower contains seven bells, the heaviest of which weighs 6 tons, a stair of 294 steps leads to the top, the view from which, embracing the town and environs, the Gulf of Genoa to the west, and the Apennines to the north-east, is very beautiful. Among churches worthy of mention are those of S. Stefano ai Cavalieri, built in 1565-96; S. Caterina, erected about the middle of the thirteenth century, S. Francesco, also of the thirteenth century, now used as the Museo Civico; the very old S. Michele in Borgo; S. Niccolò, dating from about 1000; S. Paolo, with a fine façade; and S. Maria della Spina, dating from the thirteenth century. Other edifices are the Campo Santo, or cemetery, the most remarkable structure of the kind in existence, consisting of a rhomboidal court, lined with arcades of white marble, adorned with bass-reliefs, frescoes, and paintings, by the earliest Italian masters, and full of remarkable monuments; the Palazzo Agostini, a fine fifteenth-century brick building; the Palazzo Medici, built in 1027; the town-house (Palazzo del Comune, with the city archives); the court-house (Palazzo Pretorio); the university, anciently famous, and still one of the most celebrated in Italy, with about ninety teachers and an average yearly attendance of about 750 students; the botanical garden, one of the oldest in existence; the museum of natural history, the corn exchange; hospitals, &c. Pisa is the see of an archbishop, the residence of a civil and military governor, the seat of a court of first resort, and several important public offices, and possesses several societies, economical, literary, scientific, and artistic. The manufactures consist of silk, woollen, and cotton goods; soap, white-lead, vitriol, glass, &c.; and the trade is chiefly in corn, oil, and wood for fuel. The population, which reached 150,000 when the city was in its zenith, was in 1901, 61,279. The province of Pisa has an area of 1180 square miles. The south-east and centre are occupied by ramifications of the Apennines, but the north consists of extensive plains, which become depressed towards the shore on the north-west, and contain several shallow lakes, adjoining which are large and unhealthy swamps, known by the name of Maremma Pisana and Maremma Volterrana. The soil is generally fertile, and corn, wine, oil, and fruit are very abundant. Pop. (1901), 320,020.

Pisa was an ancient Etrurian city, and one of the twelve cities of the confederation. In 180 B.C. it

became a Roman colony. About the beginning of the Christian era it was a flourishing city. On the fall of the Roman Empire it was pillaged by the Goths, and afterwards subjected by the Longobards. In the tenth century it had succeeded in taking a lead among the Italian states. In 1050 the Pisans made themselves masters of Sardinia and Corsica, in 1063 destroyed the Saracen fleet near Palermo, in 1096 took part in the first crusade, and in 1117 conquered the Balearic Islands. In the intestine wars of the peninsula Pisa became the most powerful champion of the Ghibelline cause, and suffered severely at the hands of the victorious Guelfs. The protracted wars which the Pisans carried on against their rivals the Genoese led to their disastrous defeat near Leghorn, in 1283, and the peace concluded in 1300 compelled them to evacuate Corsica and other possessions. In 1326 the kings of Aragon got possession of Sardinia. The city was further weakened by internal dissensions, and fell a victim to the ambition of the condottieri. It finally came under the power of Duke Galeazzo Visconti of Milan, from whose son Florence obtained it by purchase in 1406. The city was compelled to surrender by famine, and the larger part of the citizens emigrated. But in 1494, when Charles VIII. of France made an expedition into Italy, Pisa rose against Florence, and for fifteen years fought gloriously for her liberty. At length the citizens were compelled by famine to submit to the Florentines (June 8, 1509), and thus ceased for ever to be independent. On the ruins of Pisa was founded the power of the Grand-duchy of Tuscany.

PISA, COUNCIL OF, a general council of the Roman Catholic Church, held in the beginning of the fifteenth century to consider the pretensions of the rival popes of Avignon and of Rome. This council was opened at Pisa, 25th March, 1409, and was composed of twenty-two cardinals, four patriarchs, twelve archbishops, eighty bishops, together with representatives of twelve archbishops, 102 bishops, and a great number of doctors of theology, abbots, and other ecclesiastics, and the representatives of several kings, princes, and universities. The rival popes, Benedict XIII. (of Avignon) and Gregory XII. (of Rome) were summoned to appear within a stated period, but they refused to comply. After mature deliberation both popes were formally deposed, and Cardinal Pietro Philargi, archbishop of Milan, was elected. The authority of the council was not, however, generally recognized, and it was not until 1417 that the schism can be said to have terminated.

PISANO, NICCOLA, a sculptor and architect, born at Pisa about 1205, spent the most of his life there, and died in 1278. He holds an important place in the history of Italian art, inasmuch as his works presented a sudden and new development and far surpassed those of his immediate predecessors. Among his most famous works are the reliefs on the chancel of the baptistery of Pisa, the choir of the cathedral of Siena, and the beautiful sarcophagus of St. Dominic in Bologna. His chief architectural works are churches in Pisa, Pistoja, and Volterra.—**GIOVANNI**, the son and scholar of Niccola Pisano, was born in 1240, and died in 1320. He laid out the famous Campo Santo, in Pisa, executed the monuments of Urban IV., Martin IV., and Benedict XI. in the church of Perugia, built the front of Siena cathedral, and produced a richly sculptured altar in the cathedral of Arezzo.—Another son, **ANDREA PISANO**, the friend of Giotto, executed the statues on the belfry of Florence cathedral, and the beautiful bronze doors of the baptistery there.

PISCES, or FISHES. See **ICHTHYOLOGY**.

PISCES (the Fishes), a sign of the zodiac, which is entered by the sun about the 19th of February.
Vol. XI.

The constellation which occupies the sodiacal region corresponding to the sign has the same name; it contains some interesting double stars.

PISCICULTURE, the art of artificially hatching and rearing fish. During recent years the hatching of fish from artificially fertilized eggs has, owing to the alleged decrease in the number of useful fishes, attracted great attention both in Europe and in America. Before the process of artificial impregnation was discovered fishponds existed in most countries for rearing fish, while for many centuries the Chinese have been in the habit of hatching fish from naturally fertilized eggs. It may be taken for granted that as long as there was an abundant supply of fish no attempt was made either to protect them or to increase their number by artificial means; that in fact it was only when a great increase in the population led to a scarcity of fish and other kinds of food that man recognized the necessity of doing something to meet the increased demand for fish, either by guarding against the pollution and the overfishing of the most productive waters, and by increasing the supply by artificial means, or both. China and Egypt may be mentioned as nations which at an early period were densely populated, while the United States is an example of a nation which has rapidly increased during recent times. Accordingly we find that the Chinese and the Egyptians long ago engaged, apparently with great success, in fish-culture, while at the present day pisciculture as now understood is nowhere more extensively practised than in the United States.

Judging from what takes place at the present day in China, it appears that fish-culture to the ancient Chinese meant the distribution all over the country of naturally fertilized eggs obtained by introducing twigs into, or by throwing hurdles and mats across, the rivers frequented by fish; and further, the feeding of the fry when hatched by breaking fowls' eggs over the surface of the water. In all probability a similar method was practised by the Egyptians; but, like the Romans after them, they seem to have devoted their energies chiefly to the construction of ponds in which large numbers of fish were successfully reared, apparently with considerable profit. Although the poor as well as the rich engaged largely in Egypt in what might be called *aquiculture*, it seems that in Rome nearly all the fishponds belonged to the nobles, and that they were often constructed and maintained regardless of expense. This is partly accounted for by the rich Romans being extremely partial to fish as food, and partly because fish-culture was for a time their favourite pastime—mulletts, eels, and lampreys receiving the greatest possible attention and fetching sometimes fabulous sums when sold, as much as £240 having once been paid for a single mullet.

From Varro's work *De Re Rustica* it seems the Romans devoted much care to the construction of marine as well as fresh-water fishponds, and that the latter were often subdivided into compartments adapted for the different kinds of fish. Following to a certain extent the example of the Chinese they sometimes collected from the sea the eggs of such fish as frequented estuaries and rivers and deposited them in artificial ponds and lakes, and they occasionally introduced new fish into their waters. Optatus, *e.g.*, brought a large number of a species of *Scorpus* from the Carpathian Sea (or sea near Crete and Rhodes), and set them free in the Bay of Naples, and protected them from the fishermen for several years. From monastic and other records it is evident that fishponds were more or less common until comparatively recent times both in Britain and on the Continent of Europe, and it may be predicted, now that great

advances in the art of fish-culture have been made, that they will soon again increase in number. Although a form of fish-culture reached a great development in ancient times, what we now usually understand by pisciculture is practically a modern invention. The discovery of artificial fertilization is said to have been made in the fifteenth century by Dom Pinchon, a Portuguese monk; but if he really made the discovery no practical results followed, and to Jacobi, a wealthy German gentleman of Westphalia, we are indebted for the first impulse in the right direction. The results of many experiments made by Jacobi on his estate at Hohenhausen were made known in France in 1770, and in England some eight years later. Although the British government appreciated Jacobi's discovery sufficiently to grant him a pension, no great advance was made until 1837, when John Shaw of Drumlanrig, in the south of Scotland, made experiments on the Nith, and succeeded in rearing trout from artificially impregnated eggs, and at the same time in increasing our knowledge of the life-history of the salmon. In 1841 Remy, a French peasant in the Vosges department, having been struck with the failure of the fish supply, began to study the habits of trout during the spawning season. With the assistance of a companion (Gehin), Remy made a number of experiments with trout ova, and finally succeeded like Shaw in hatching trout from artificially fertilized eggs; but Remy and Gehin were more fortunate than Shaw, in as far as their work was taken up and extended by the French government, who, in 1848, constructed the great hatchery of Huningue, near Basel, which has, to a great extent, been the means of restocking the once impoverished French lakes and rivers. Soon after the Huningue hatchery had been established under the direction of Professor Coste, several similar institutions were formed in Germany and Britain, and at a later date in the United States and Canada, and nearly all countries have now provided themselves with hatching stations. One of the earliest of these establishments is the Stormontfield hatchery on the Tay, which was begun in 1853; but the most perfect as well as the most celebrated is the one erected by the late Sir James Gibson-Maitland at Howietoun, near Stirling.

Pisciculture is now, however, no longer chiefly confined to salmon and trout. Since the appointment of the United States Fishery Commission in 1871, successful experiments have been made in the artificial cultivation of shad, cod, and other sea-fish, and also with oysters and clams; while the hatching of other molluscs, and of lobsters and other crustacea, has already been attempted in several countries, so that pisciculture now occupies a large and ever-increasing field of usefulness. Indeed it may now be said to include not only the hatching of useful fishes, but also the introduction of new forms, and the study of their habits and life-history, as well as a study of the food of fishes and the enemies of the valuable kinds, and in the case of the salmon and allied forms the providing of facilities when necessary to enable them to reach their spawning ground. The care of fisheries and the prevention of bad (because unnecessarily destructive) methods of fishing also falls to the modern pisciculturist.

The importance of the discovery of the method of artificial impregnation will be at once evident. In the higher vertebrates (birds, reptiles, and mammals), living in natural conditions, very few eggs reach maturity at a time, and usually all the eggs are fertilized, and to a great extent protected during the development of the embryo, and the young when they appear are often carefully tended and fed. In the case of most fish, on the other hand, fertilization

of the eggs is less certain, and during the whole of the developmental process they are absolutely unprotected, and the fry have not only to protect themselves as best they can from a multitude of enemies, often including the older members of their own family, but they have further to obtain unaided their own food. It is owing to this want of protection that so many fish, in order to have a chance of surviving, have to produce an enormous number of eggs—some, such as the cod, turbot, and sturgeon, forming several millions every season. It is because of this richness in eggs that so much is possible to the pisciculturist, and that without much trouble he may, when he desires, more than make amends for the disturbance of the balance that results from his capturing annually many millions of the various food fishes. It is well known how rapidly hares and rabbits multiply when their surroundings are favourable, and it can be easily understood that in order to increase any given fish to an almost unlimited extent it is only necessary (1) to ensure that a large percentage of the eggs produced are fertilized, and (2) that the eggs, and afterwards the young fish, are protected; and the longer the protection of the young, the greater the chance of maturity being reached. Sometimes no attempt is made to protect the fry; the eggs, when well advanced in development, are turned out, or the fry are allowed to escape almost as soon as they are hatched. This system has been especially carried on in Canada and the United States, and although it may give excellent results in some instances, there is always an element of uncertainty about it. In the case of salmon the 'eyed' ova may never hatch, or the fry when hatched by artificial means may be (owing to overcrowding, changes in the temperature, or other causes) too weak to survive. Hence, until it has been proved that the method of hatching adopted gives strong well-formed fry, it is usually better not only to keep the eggs until they hatch, but also to protect the fry until they are well able to care for themselves. In this way double protection is, as it were, given. By taking the milt and roe from the breeding salmon and hatching the eggs in such a way that weak fry incapable of surviving are produced, pisciculture may be the means of diminishing, rather than of increasing, the number of fish in any given river; whereas if healthy feeding fry are introduced into a river, there cannot be much doubt as to the result. When an attempt is made to protect the fry as well as the eggs, the question of feeding at once arises. For years the difficulty of providing suitable food for salmon fry in a convenient form seemed insurmountable, but now this difficulty has been completely overcome, chiefly through the perseverance and ingenuity of Sir James Gibson-Maitland, who carried salmon culture to so wonderful perfection that he could not only fertilize and hatch 98-99 per cent of the eggs obtained, but also rear almost all the fry hatched until ready for migrating to the sea.

Fish-culture is an industry which, in the case of the sea-fisheries at least, requires at the outset the expenditure of large sums of public money, and which, in order to be of any real service, requires to be conducted on a very large scale. Statistics might be given to indicate what has already been done, but at the best they are far from satisfactory. It will be better to mention two examples of the results gained. By introducing two millions of young fish, during five consecutive years, into the Sacramento River, California, the catch was increased from five millions to fifteen millions of pounds. Again, by introducing young cod into Gloucester harbour, Massachusetts, it has been shown that even the supply of migratory sea fish can be influenced, for deep-

sea cod were soon taken in the harbour, where they were never found before. It is now possible to arrest for a time the development of the eggs of fish, and forward eggs in perfect safety not only across the Atlantic, but to the most remote countries; while young fish can easily be conveyed from one side of the American continent to the other. The natural movements of salmon and other fish have now been facilitated on various rivers by the erection at falls and cataracts of suitable fish-ways, the Macdonald fish-way having already opened up many miles of valuable spawning ground.

In an article of this kind it is impossible to discuss at length the various methods adopted for hatching the different kinds of fish eggs, far less to give an account of the numerous hatching-boxes that have been used in different countries. It will be sufficient to indicate shortly how the hatching of some of the common food fishes is carried on.

Although the eggs of fishes vary greatly in form and number, they can be readily arranged under one of four groups, viz.: (1) Eggs which sink, for example those of the salmon. (2) Eggs which float, as those of the cod. (3) Eggs which are semibuoyant, as those of the shad; and (4) Eggs which are adhesive, as those of the herring. This being the case the hatching apparatus naturally requires to be adapted for heavy, floating, and adhesive eggs.

By way of illustrating how heavy eggs are manipulated, we shall refer to one of the methods adopted for hatching salmon. In order to hatch large numbers of salmon it is necessary at the outset to provide a hatching-house. This should be as far as possible under-ground, so that the temperature remains nearly constant during both summer and winter. The hatching-house should be furnished with a number of hatching-boxes and with large shallow wooden trays for rearing the fry. Each hatching-box (see the plate, fig. 2) is provided with four grilles, and should be capable of accommodating about 20,000 eggs, arranged as seen in figure 3 in rows between glass tubes, which are fixed in strips of perforated zinc in such a way that they can be easily replaced. The glass grilles, instead of being arranged in groups of four in a wooden box, may be arranged in a series of earthenware troughs (fig. 4), each trough (fig. 5) being provided with a shallow spout and rests for supporting the frame (fig. 6), containing the glass tubes of the grille. Given a hatching-house with hatching-boxes, the next requisite is a supply of pure clear water, which should, if possible, be conducted to the hatching-house under-ground. The supply of water determines the number of eggs that can be hatched—for every 100,000 trout eggs 10 gallons of water are required per minute in order to give strong vigorous fry.

The hatching-house and water supply having been arranged, and the salmon or trout selected, the female is held as seen in fig. 1, and the eggs allowed to fall into a dry pan. When a sufficient number of eggs have been obtained a small quantity of milt is expressed from the male, and the pan tilted and gently shaken so as to facilitate the diffusion of the milt. Some water is then added, and after stirring the mixture with the hand the eggs are allowed to rest for about half an hour—the time varying with the temperature. When the eggs have 'hardened', pure water is poured gently over them until all the milt is removed; they are then ready to be conveyed in a carrying-can and deposited on the grilles in the hatching-house. All that is further required is that the dead eggs should be removed as they become white. At the end of six or eight weeks the developing eggs may be removed from the grilles and packed in trays on damp swans-down or moss, and

forwarded with perfect safety all over the world. A transportation box for transmitting salmon eggs between layers of moss is represented in fig. 7.

The eyed ova may be deposited in either natural or artificial *redds*, as they are called. In either case the temperature of the water should, if possible, not vary more than 5° Fahr., and unless the fry are to be fed when hatched, the redd should be in the vicinity of sufficient food. A convenient form of a redd is represented in fig. 8. It consists of a settling pond (a), from which the water passes through gravel (b) to reach the redd proper (c). This consists of a trench about 2 feet wide at the bottom and 4 feet at the surface, containing first a layer of stones (see section figure 9), then coarse gravel, and finally a coating of fine clean washed gravel. From the redd a channel (d) filled with gravel may be continued to a rearing pond. The eyed ova are deposited amongst the fine gravel on the surface of the redd. Hatching takes place about the end of April. The young fry (alevins) usually remain hidden amongst the gravel for about six weeks until the yolk-bag is absorbed, when they begin to feed. About this time they should be allowed to escape from the artificial redd into a rearing pond, and there fed until about midsummer on a mixture of beef and yolk of egg—about nine yolks to a pound of beef. A section of a fry pond is represented in fig. 10, which shows (e) the pipe by means of which it can be annually cleaned. After midsummer the fry begin to rise and take their food in the ordinary way; they may then be placed in an ordinary pond or introduced into a river. The fry can easily be transported for considerable distances in large tanks, and even yearlings stand a forty hours' journey remarkably well, but large trout cannot be trusted longer than ten to twenty hours in the tanks, and they require considerable attention *en route*. In the United States metal trays covered with iron wire have been substituted for the glass grilles. Five or six trays are arranged above each other like those in Ferguson's hatching jars (fig. 11), so that there is great economy of space, and, notwithstanding the crowding, the results are excellent.

Nearly all adhesive as well as all heavy eggs deposited in fresh water can be hatched in the same apparatus as salmon and trout eggs, the adhesive eggs of the smelt, e.g., having been successfully hatched on glass grilles at Howietown. The eggs of the cod, haddock, turbot, sole, and of other fish which produce floating eggs, require very different treatment from the heavy eggs of the salmon and trout. Any apparatus that prevents the eggs escaping suffices for hatching small numbers for experimental purposes. The eggs of the cod have been hatched in great numbers by the United States Fish Commission, as well as in Newfoundland, Norway, and elsewhere. The eggs may be collected from fish caught for the market, in specially constructed carrying cans, or taken from live fish kept in tanks near the hatchery, or gathered from the surface waters of tanks in which the breeding fish are kept. Formerly they were placed in floating hatching boxes (fig. 15), into which water entered by a wire-cloth bottom to escape by openings near the margin, also guarded by fine wire-cloth; at a later date the eggs were hatched in what are known as McDonald's hatching jars (fig. 12a). The water in these is conducted to the bottom of the jar by a glass tube, and from the bottom it rises to escape by a second tube (fig. 12a) below the surface of the water. In this way the eggs are kept in constant motion, and yet they are not carried away by the outward current. The young cod when hatched can be collected in a similar jar by guarding the opening of the outlet tube (fig. 12b). The mode of treating floating eggs adopted in recently constructed

European hatcheries may be exemplified by describing the practice at the Scottish Fishery Board's hatchery. There spawning-fish are kept from year to year in large tanks; in the season their fertilized eggs are secured from an overflow, and after being washed are put into hatching-boxes. Carefully filtered water of high specific gravity is supplied to these boxes, and as many as 400,000 eggs may be accommodated in each cubic foot of water in them. The eggs are kept in motion by a periodic movement of the boxes, due to a simple mechanism that is worked by the same water that flows through the hatching-boxes. In this way a regular distribution of the eggs is secured and an equal share of fresh water to all. In Norway, where several million cod eggs are hatched out annually, the price per million is only about £2, or rather over 2000 young fish for a penny. The eggs of plaice, and other fish with floating eggs, have been successfully hatched in the same way as cods' eggs.

Semibuoyant eggs can be readily hatched in the M'Donald jars. Many millions of shad eggs have been hatched by the United States Fish Commission. Some have been hatched in floating boxes (fig. 22), while the Bell and Mather hatching-cones (fig. 14) have been used for others. The shad eggs are taken from the fish, and having been fertilized they are transported in special crates (fig. 13) to the hatching station, where they are at once transferred to the hatching apparatus. When hatched they can be easily forwarded considerable distances in cans similar to those used for salmon fry.

Adhesive eggs may either float or sink. For some floating adhesive eggs the Bell and Mather cone (fig. 14) might suit well, while the M'Donald jar (fig. 12) might be better adapted for others. Adhesive eggs which sink have hitherto been hatched most successfully on plates of glass arranged in wooden boxes. Sometimes the sheets of glass are arranged (as in Clark's box) so that the water enters at one end of the box to escape by the other, after coming in contact with the various plates (fig. 23a), while in another box used by the writer the glass plates are arranged horizontally with a jet of water between each (fig. 18). Equally good results are obtained when the eggs are deposited on flat stones or pieces of sea-weed if a sufficient current of pure water is allowed to run over them. M'Donald jars have been largely used for hatching lobster eggs in recent years.

In fertilizing small adhesive eggs, such as those of the herring, instead of following the dry method usually adopted for large eggs (e.g. salmon and trout), it is better to express the eggs into previously fertilized water. If the eggs are to be deposited on a glass plate, it should be held in water into which some milt has been introduced; as the eggs fall and adhere to the glass they are almost certain to be fertilized. The eggs escaping in the form of a long beaded ribbon form loops as they reach the glass plate (fig. 21); but in a short time they rearrange themselves so as to form an almost continuous layer. Fig. 17 shows a hatching-box adapted for sinking to various depths to test the influence of temperature, &c., on the development of adhesive eggs, while in fig. 20 an apparatus is represented for depositing stones, &c., coated with adhesive eggs on deserted spawning banks.

The cultivation of oysters is in many respects a more important industry than that of salmon, but although it has been engaged in from at least the time of Sergius Orata, who bred oysters in the Lucrine Lake in the seventh century, the method of artificially impregnating the eggs has only recently been discovered, the credit of the discovery belonging to the United States Fish Commission. Unlike fish, each oyster forms both eggs and sperms, the eggs reaching maturity at one time and the sperms at another, so

that cross fertilization is secured—each oyster shedding about a million eggs during the spawning season. There has not yet been time to ascertain what influence the discovery of the artificial fertilization and hatching of oysters will have on increasing the supply, but it is hoped that it may be the means of restocking many of the now all but exhausted beds. Hitherto oyster-culture has essentially consisted in collecting the young oysters (spat) during their free swimming stage, and rearing them either on natural or artificial banks. The young oysters often settle at places where food is not sufficient or not of the right kind to let them grow well, and the work of the oyster-farmer is to keep his best feeding-grounds always well stocked. For many years oyster-culture has been carried on with considerable success on the French coast, and recently a number of satisfactory experiments have been made at the Zeeland oyster-beds by the Dutch government. In England and Germany oyster-culture in the sense of oyster-breeding has hitherto practically proved a failure. At Arcachon (south of Bordeaux), where the best results have been obtained, a stock of full-grown oysters has always been maintained on the banks. This has been of the first importance, because it has not yet been possible to breed oysters satisfactorily in oyster parks. The oyster-culturist at the present time devotes his energy first to collecting the spat, and next to rearing as many marketable oysters as possible from the spat collected. The spat may be collected on bundles of faggots (fascines) which are anchored on the oyster-bed. After five or six months the faggots are removed, and the young oysters, of which there may be several thousands on each faggot, are detached and deposited on the bank amongst the old oysters, or they may be conveyed to an exhausted bank, or an oyster park.

Instead of faggots, platforms may be used, or the spat may be collected on frames (fig. 29), arranged in boxes through which water enters freely by the bottom, to escape by holes in the sides. When a box has been fixed by means of four stakes a number of nearly mature oysters are placed on a layer of shells under it, while others are laid on the frames after they have been similarly coated with shells. When the spat escapes it readily adheres to the shell previously laid on the frames, where it develops into oysters that in five or six months can be easily removed. The spat is sometimes collected on irregular blocks of stone and often on curved tiles (fig. 28) which have been previously coated with cement or lime to admit of the young oysters being afterwards removed without fracture of their shells. The tiles may be arranged in a single layer and retained in their place by stones, or there may be several layers; or instead of occupying a horizontal the tiles may occupy an oblique position. The spat which adheres to the hollow side of the tile may be removed and deposited where desirable.

Another mollusc much sought after is the mussel. Mussels once existed in great abundance around the shores of Britain, but now nearly all the unprotected mussel-banks have been destroyed by over-dredging. Still, not only might the banks be restocked, but many miles of mud-flats, which have hitherto provided nothing for man's use, might easily be made to yield splendid crops of mussels every season. At Aiguillon on the French coast, not far from Rochelle, mussels have long been cultivated by means of wattles, and no better system than the 'wattle' system has yet been discovered. It has, however, not succeeded very well in experiments made on the Scottish coast, as storms proved very injurious to the wattles, and the expense of upkeep was heavy.

The young mussel, like the young oyster, after

swimming about for a short time fixes itself to stones, shells, or other substances. During the free stage the young mussels usually move in and out with the tide; while this affords them an opportunity of extending their distribution, it also incurs the risk of their being carried far out to sea, where further growth is impossible. About the end of their pilgrimage they, as it were, begin to look out for a fixed abode, as near shore as possible. In many instances the sea-bottom near the shore is covered with a thick layer of mud and sand, over which they pass again and again without finding a suitable resting-place. It is in such cases that wattles, by providing a convenient surface of attachment, are so useful. In ordinary circumstances several forms of wattles are in use. 1. There is a row of stakes (*low crawls* they are called) within about a foot of each other, which are only uncovered at spring-tides, these secure many of the young mussels which otherwise would be carried out to sea. 2. There are two rows of *false crawls* in which the stakes are about 18 inches apart, with the intervening spaces filled up with wickerwork. The false crawls are freely exposed during both spring and neap tides. 3. There may be two or more rows near the shore which are exposed several hours every day, and are known as *high crawls*. When the mussels on the low crawls are about the size of a bean they are collected in baskets (fig. 25), and conveyed in a small flat-bottomed canoe (an *aeon*, fig. 26) to the wickerwork of the false crawls, where they are attached in bags of old netting, &c., which soon rot. When they have increased in size so as to occupy the whole of the available space provided by the false crawls (fig. 27) they are next removed to the high crawls, where they remain until they reach maturity. The wattles may be arranged so as to assume a V shape (fig. 24), with the pointed end opening towards the sea, or they may be arranged in parallel rows. The stakes should project about 6 feet above the surface of the mud, and be from 18 to 20 inches apart, while the wickerwork should consist of long thin branches capable of being closely woven between the stakes from near their top to within about 8 inches of the bottom (fig. 27). The *aeon* is simply a wooden box about 9 feet in length which the fisherman pushes along over the mud.

Although the necessity of increasing the supply of lobsters and other crustacea has been recognized, little of a practical nature has hitherto been accomplished. The naturally fertilized eggs of both lobsters and crayfish have been artificially hatched, and the young reared to a considerable size. In America many hundreds of millions of young lobsters have been hatched out from the 'berries' taken from the hen lobsters, and thereafter liberated in the sea.

In conclusion, it may be pointed out that while we can undoubtedly benefit a fishery that is depleted, if we introduce large numbers of fish eggs or young fish into the waters, it does not follow that in other circumstances there is any real advantage in doing this, as fish produce so many eggs that as a rule many must succumb in the struggle for existence, and the number of adults is probably limited by the quantity of suitable food and shelter available for them. Again, it may be noted that it is wiser to avoid destroying by careless fishing the young fish that have already survived many of the perils of the sea than to turn out even a much larger number of helpless newly-hatched fry to take their chance in the struggle for food.

PISCINA, a hollow stone basin or trough, with a channel leading to the ground, placed near the altar in churches, and fixed at a convenient height above the floor. It is used to hold the water in which the priest washes his hands, and for rinsing the chalice.

PISE, an economical material for forming the walls of cottages, agricultural buildings, &c., consisting of stiff earthy materials well rammed into a frame, and when dry forming a good strong wall.

PISEK, a town of Bohemia, on the right bank of the Wottawa, here crossed by one of the finest stone bridges in the country, 52 miles south by west of Prague. It is surrounded by an old and lofty wall, flanked with numerous towers, and is well built. It carries on iron-founding, forging, brewing, &c. Pop. (1890), 10,950.

PISGAH, a mountain on the east side of the Lower Jordan, from the top of which Moses had a view of the Promised Land. The mountains here furnish an extensive prospect over Palestine.

PISIDIA, an ancient province of Asia Minor; a mountainous region traversed by part of the Taurus range. The inhabitants were mountaineers, and were never really subdued by the Romans, even when the country was nominally a province of the empire.

PISISTRATUS (Greek, *Peisistratos*), 'tyrant' of Athens, was born not later than the year 612 B.C. He was rich, handsome, and eloquent, and being by nature ambitious he soon placed himself at the head of one of the three parties into which Attica was then divided. These were: the party of the Plain, comprising the landed proprietors, then headed by Lycurgus; that of the Coast, or wealthy trading class, headed by Megacles, and that of the Highlands, mainly made up of the labouring population. Thus being the party that seemed most likely to further the designs of Pisistratus he threw in his lot with it, and secured its allegiance by coming forward as the patron and benefactor of the poor. In all his public speeches he was the advocate of civil equality and a democratic constitution. Solon saw through his policy, and expressed his apprehensions of the result. They were but too soon verified. One day Pisistratus appeared in the market-place with several slight wounds, which he had inflicted on himself, and called upon his fellow-citizens to protect him against certain alleged enemies, who had, as he said, attacked his life on account of his adherence to the democracy. An assembly of the people was immediately summoned, in which Ariston, one of his friends, proposed that a guard should be given him for the security of his person. This proposal was approved, notwithstanding the opposition of Solon. A body guard of fifty men was voted him; this force he soon greatly increased, and in 560 B.C. he seized upon the acropolis (citadel). He was now master, or, as the Greeks termed it, 'tyrant' of the city, while Solon departed from his enslaved country. But though a tyrant in the Greek sense, his use of power was by no means tyrannical. He made no attempt to abolish the wise laws of Solon, but confirmed and extended their authority. But his position was not secure. Megacles left Athens with his family, and entered into a correspondence with Lycurgus, for the purpose of overthrowing the power of Pisistratus. Their project succeeded, and Pisistratus was compelled to leave the city. But Megacles soon became dissatisfied, and offered to reinstate Pisistratus if he would marry his daughter. This proposition he accepted, and his return was soon effected. Not long after Megacles again made common cause with Lycurgus, and Pisistratus retired voluntarily to Eretria. Here he took measures to recover his power. Contributions were solicited from friendly cities, and were freely granted, Thebes especially surpassing all the rest in this respect. Being thus supplied with money and troops, in the eleventh year of his second banishment Pisistratus entered Attica at the head of an army, and having dispersed the troops sent against him he entered the city, and

made himself master for the third time of the sovereignty. He continued to rule with his former mildness; but, in order to weaken the popular party, he adopted a measure which was very useful to the state. He forced many of the idle inhabitants to leave the city and cultivate the country around, which by these means was covered with corn-fields and olive plantations. Those who had no resources of their own he supplied with cattle and seed. He exacted from every one the tenth part of his income and earnings, and thus increased the revenue of the state, which he expended in splendid public buildings. He established a public library, and collected and arranged the poems of Homer. As he well knew how tyranny was hated he carefully concealed his power under the exterior of a private citizen. He submitted like others to the jurisdiction of the Areopagus, before which he was accused of murder, and conducted himself with as much prudence as clemency. In this way Pisistratus exercised the sovereignty not as the oppressor but as the father of his country, which scarcely ever enjoyed a longer term of peace and prosperity. He died 527 B.C., leaving two sons, Hippias and Hipparchus, to inherit his power, who were not, however, able to preserve it. See HIPPIAS.

PISOLITE. See PEASTONE.

PISTACHIO NUT is the produce of *Pistacia vera*, a small tree belonging to the natural order Anacardiaceae, a native of Western Asia, now cultivated in many parts of Southern Europe and the Levant. The nut is of a reddish-green tint, and about an inch long, oval and acuminate; the kernel is bright green, and has an agreeable flavour. The fruit is much used by the Turks and Greeks. Another species (*P. lentiscus*), growing in the same regions, yields the gum called mastic. The genus includes also the turpentine tree or terebinth. See MASTIC.

PISTIL, in botany, the female organ of a phanerogamous flower, occupying almost invariably the centre of the flower. In most cases there is only a single pistil in a flower, as in the lily, hyacinth, and poppy; in other instances there are several in the same flower, as in the rose and ranunculus. It consists essentially of two parts, the *ovary* or *germen*, containing the ovules or young seeds, and the *stigma*, a cellular secreting body, which is either seated immediately on the ovary (as in the tulip and poppy), and is then called *sessile*, or is borne on a stalk called a *style*, interposed between the ovary and stigma. The style is not necessary for the perfection of the pistil. Like the other organs of plants the pistil consists of one or more modified leaves, which, in this instance, are called *carpels*. When a pistil consists of a single carpel it is *simple*; when it consists of several, more or less united, it is *compound*. Each carpel has its own ovary, style (when present), and stigma, and is formed by a folded leaf, the upper surface of which is turned inwards towards the axis, and the lower outwards; while at its margins are developed one or more buds called *ovules*. The ovary always occupies the lower part of the pistil. It represents the limb or lamina of the leaf, and is composed of cellular tissue with fibro-vascular bundles and an epidermal covering. A transverse section of the ovary often shows a single internal cavity or *cell*, containing the ovules, in which case it is called *unilocular*; when there are two cells, it is called *bilocular*; when there are three, *trilocular*; when there are a great number, *multilocular*. The ovarian cells of some flowers contain only one ovule, others contain a great number. After flowering is over and fecundation has taken place, the cellular tissue enlarges and opens the pulpy mass of the fruit, the epidermal covering becomes the rind, whilst each ovule is

developed into a seed. The style and stigma either fall off, or remain and dry up, or increase in size, becoming feathery awns, beaks, &c. The style has usually a cylindrical form, and is traversed by a narrow canal, in which there are some loose projecting cells, forming what is called the conducting tissue, from the part which it plays in conveying the influence of the pollen to the ovules. The stigma is a continuation of the cellular tissue in the central part of the style, placed at the summit of the ovary or style, and destined to receive the influence of the fecundating substance from the anthers of the stamens. It is composed of cellular tissue more or less lax, and often having projecting cells in the form of papillae or of hairs, and at the period of fertilization exuding a viscous fluid, which retains the grains of pollen, and causes the protrusion of tubes. When situated at the summit of the style or ovary the stigma is said to be *terminal*; it is *lateral* when it occupies the sides of the style, or, when that part is wanting, of the ovary. See BOTANY.

PISTOIA (ancient, *Pistoria*), a town of Italy, in the province of Florence, and 20 miles north-west of the city of that name, with which it is connected by railway, near the left bank of the Ombrone. It is surrounded by lofty walls, has several large and handsome squares, spacious, well-paved, and well-formed streets, is the see of a bishop; contains a cathedral of ancient date, faced internally and paved with marble, and adorned with fine sculptures and paintings; the church Dell' Umiltà, with a magnificent dome; several other churches, a town-house, court-house, &c., and has manufactures of woollen and silk goods. Pistols were first made here. Pop. (1881), 12,224.

PISTOL, a small fire-arm with a curved stock, discharged with one hand, named from the town of Pistoia, where they were first made. Mention is made of their use in 1544. Being intended for fighting at close quarters, accuracy of aim was not attempted to be secured; in fact this would have been impracticable until the adoption of the fire-lock towards the end of the seventeenth century; and for a long time pistols were not generally provided with sights. The 'dag' mentioned by the Elizabethan writers was a kind of clumsy pistol. They were carried by the English cavalry as early as the reign of Henry VIII. Pistols have been made of various sizes, ranging from 6 inches (the saloon and pocket pistol) to 18 and even 24 inches (the holster pistol), having sometimes one barrel, sometimes two. The mechanism of this arm resembles that of the musket or rifle, and the revolver principle is now universal. See REVOLVER.

PISTOLE, a gold coin met with in several parts of Europe, more especially in Spain, Italy, Switzerland, and some parts of Germany, but not now coined. It was originally a Spanish coin, and was equivalent to a quarter of a doubloon; the present Spanish pistol has a value of 16s. 2d.

PIT, in horticulture, the name applied to an excavation below the surface of the soil, intended to be covered by a glazed frame. In their simplest form, without any artificial heat, they are useful for protecting plants from the cold in winter; and even in summer this kind of pit affords a convenient means of sheltering delicate plants from heavy rains and a scorching sun. They may have turf, wood, or brick sides. When a strong heat has to be constantly maintained it may be kept up by fermenting matter, or by flues from a fire.

PITA HEMP, a name given to the fibre of the agave or American aloes. See ALOE.

PITAVAL, FRANÇOIS GAYOT DE, a French juriconsult and miscellaneous writer, was born at Lyons

in 1673. He was successively abbé, soldier, lawyer, and man of letters. The most important and best known of his works is a collection of criminal trials—*Causés Célèbres et Intéressantes* (1734–43, twenty vols. 12mo), a work subsequently supplemented by La Ville (1769, four vols.) and by Richer (1772–88, twenty vols.).

PITCAIRN ISLAND, an island in the South Pacific, belonging to the Low Archipelago, lat. 25° 5' n.; lon. 130° 5' w.; length, 2½ miles; breadth, about 1 mile. Its coast is almost perpendicular throughout its whole extent, and is, moreover, fringed with formidable rocks and reefs, making it impossible to land except at a very few points—one at the west end, and another on the north-east, called Bounty Bay. The last is that generally used, but even it becomes impracticable in strong winds. The island, rising to the height of 1100 feet, becomes visible at a distance of 50 miles, and when more nearly approached presents a somewhat wild but beautiful appearance. Its summits are clothed with luxuriant verdure, and the bases of its lofty cliffs are skirted with thickly-branching evergreens. But the interest which attaches to Pitcairn Island is derived far less from its physical than from its moral features. In 1790 nine British sailors, mutineers of the *Bounty*, landed on it, with eighteen natives of Tahiti, six men and twelve women. They found proof of former but no actual inhabitants, and might easily have managed, from the natural fertility of the soil, to subsist in tolerable comfort; but violent dissensions soon arose, and they commenced killing each other, and at the end of ten years the only survivors were John Adams, an Englishman (whose real name was said to have been Alexander Smith), the females, and nineteen children. Providentially among the articles which the mutineers had brought with them were a few Bibles and prayer-books, and Adams, partly by the perusal of them, was stung with remorse for his past life, and became a genuine Christian convert. He took upon himself the religious training of the little community, and with such remarkable success that probably since the first planting of the gospel its genuine fruits have never been produced more purely and abundantly than on this lonely islet of the Pacific. In 1808 Captain Folger, an American, touched at the island, and reported the state of matters to the British government. In the autumn of 1814 a British vessel called at the island, and found Adams still alive and commanding the respect and admiration of the little colony. Every successive visitor seemed to vie with those who preceded him in lauding the inhabitants for their numerous virtues, social and domestic. Their kindness and hospitality were of the purest and most unsophisticated description, every individual of suitable age could both read and write; drunkenness was entirely avoided; quarrels in the usual sense of the term were unknown. In 1856 this interesting community, to the number of 191, was transferred to Norfolk Island, Pitcairn having become too small for their comfortable subsistence. Of this number about 10 soon returned to the island. In 1881, at the time of the visit of H.M.S. *Thetis*, the inhabitants were found to number 96, while in 1900 they had risen in number to over 140. A recent Colonial Office report describes them in the following terms. 'Lax in morals, weak in intellect, they are fast degenerating, and unless something is speedily done to alter their condition they will probably drift into hopeless imbecility'. Fair and blue-eyed persons are said to be common. The men employ themselves in fishing and field labour; the women assist in cultivating the soil, which yields abundance of potatoes, yams, some maize, and many varieties of fine fruit—plan-

tains, pine-apples, bread-fruit, oranges, melons, limes, &c. About once a year clothing and luxuries are brought to the islanders by a British man-of-war, and judicial cases, if necessary, are then disposed of. Serious crime is, however, very rare. The use of alcoholic drinks and tobacco is forbidden. The administration consists of a president and a parliament of five, the members elected by the inhabitants of both sexes. There was no regular clergyman on the island till 1896.

PITCH, the residuum which remains after boiling tar in an open iron pot, or in a still, till the volatile matter is driven off. It is made in Great Britain, but great quantities are imported from Russia, Norway, and North America. It is extensively used by ship-builders for caulking the seams and coating the outsides of ships and boats. An inferior kind of pitch is obtained by distilling coal-tar, and bone-tar gives an article almost equal in value to that got from wool. Much of the artificial asphalt used for building and paving purposes is made of coal-tar.

PITCH, the acuteness or gravity of any particular musical sound. A musical sound is produced by a series of atmospheric vibrations falling upon the ear at precisely equal intervals of time, and following each other so rapidly that no intermission can be perceived. The number of vibrations in a given time determines the pitch of the tone, the lower numbers giving the grave or deep tones, and the higher the acute or shrill tones. As all short and thin sonorous bodies vibrate more rapidly in a given time than larger and more massive bodies, it follows that in stringed instruments the pitch is dependent on the length, thickness, and degree of tension of the string, short, thin, and tightly-stretched strings giving the highest tones; and in wind instruments, such as the flute or organ, the pitch is determined chiefly by the length of the column of air set in motion. (See MUSIC AND ACOUSTICS.) Instruments are tuned by means of a tuning-fork, the two prongs of which are made of such a length that, when made to vibrate, a particular tone is produced. This note is generally the C in the third space of the treble clef, or A in the space below it, the latter being the note to which the second string of the violin is tuned. At the close of the seventeenth century the standard C tuning-fork made 489 vibrations per second; but in 1859 the opera pitch had risen so high as 546, which was too great a strain upon the soprano and tenor voices. A committee of the Society of Arts was that year appointed to consider the subject of a uniform musical pitch, to whom Sir John Herschel recommended the theoretical number of 512. This was objected to by instrument dealers and performers, as the instruments then in use could not be toned so low without altogether sacrificing brilliancy of tone, and no uniform pitch has been fixed in Britain. On the Continent the French pitch, C = 522, is general.

PITCHER PLANT. See **NEPENTHES**.

PITCH-STONE, a felspathic mineral containing excess of silica, and having a pitchy fracture. It is found chiefly in Southern Europe, South America, and Mexico.

PITH. See **MEDULLA**.

PITT, Earl of Chatham. See **CHATHAM** (WILLIAM PITT, EARL OF).

PITT, WILLIAM, second son of the Earl of Chatham, was born May 28, 1759. At the early age of seven he was remarkable for the interest he took in grave subjects, the ardour with which he pursued his studies, and the pithiness of his remarks. At fourteen he had all the intellect of a man, and wrote a tragedy not worse than many printed by persons of mature years. His physical development was not equal to his intellectual; he was tall, slender, and

sickly; port-wine was prescribed by the physicians, and he daily drank as much of this pleasant medicine as would have helplessly intoxicated many a full-grown man. He was educated at home instead of being, like most of his future colleagues, sent to one of the great public schools. At the age of fourteen he was entered of Pembroke Hall, Cambridge, where his knowledge of mathematics and the classics seems to have astonished ripe scholars. His acquaintance with modern literature was slight. Of living languages besides his own he was almost entirely ignorant; an imperfect knowledge of French was all he possessed. His favourite English authors were Shakespeare, Milton, Locke, Adam Smith, and Bolingbroke. His father had trained him from infancy in the management of his voice, which was naturally clear and deep-toned; and his whole education had been directed to the end of making him a great parliamentary orator. In 1777 he entered Lincoln's Inn, and in 1780 was called to the bar. He attended the western circuit once or twice, when he was introduced into Parliament by Sir James Lowther, as representative for his borough of Appleby, at the age of twenty-one. His maiden speech was delivered in support of Burke's financial reform bill, and he also spoke in favour of a reform in Parliament. On the breaking up of the Rockingham administration he became chancellor of the exchequer at the age of twenty-three, under the premiership of the Earl of Shelburne. A general peace soon followed, which being made the ground of censure by a strong opposition, the cabinet was dissolved, and the Fox and North coalition took its place. On his retirement from office Pitt resumed his efforts for a reform in Parliament. His first motion was made on the 17th May, 1782, before a house of more than 300 members, and was only lost by twenty votes, the best division reformers succeeded in obtaining till 1832. On the failure of Fox's India Bill, which produced the dismissal of the coalition, Pitt, although at that time only in his twenty-fourth year, assumed the station of prime minister by accepting the united posts of first lord of the treasury and chancellor of the exchequer. Although strongly supported by the sovereign, he stood opposed to a large majority of the House of Commons, and a dissolution took place in March, 1786. At the general election which followed the voice of the nation appeared decidedly in his favour, and some of the strongest aristocratical interests in the country were defeated, Pitt himself being returned by the University of Cambridge. His first measure was the passing of his India Bill, establishing the board of control, which was followed by much of that fiscal and financial regulation that gave so much *éclat* to the early period of his administration. The establishment of the delusive scheme of a sinking fund followed in 1786. In 1788 Pitt resisted the doctrine of the opposition that the regency, during the king's indisposition, devolved upon the Prince of Wales by right. The minister maintained that it lay in the two remaining branches of the legislature to fill up the office, but that the prince could not be passed over in nominating to this post. By the adoption of this principle he was enabled to pass a bill restricting the regent's power, which the king's recovery rendered unnecessary. The French revolution now broke out, and in 1793 war arose between Great Britain and France. The details of the momentous contest which followed form no subject for the biographer. Great Britain was successful by sea; but during the life of Pitt the conflict on the Continent was in favour of France. The suspension of cash payments in 1797, the necessity of attending to home defence, the mutiny in the fleet, and the accumulation of the public burdens which still press

so heavily on the nation, were some of the bitter fruits of this struggle. In 1800 the Irish union was accomplished. In 1801 the opposition of the king to all further concession to the Irish Catholics (see CATHOLIC EMANCIPATION) caused him to resign his post. The Peace of Amiens succeeded; and the Addington administration, which concluded it, Pitt supported for a time, and then joined the opposition. The new minister, who had renewed the war, unable to maintain his ground, resigned; and in 1804 Pitt resumed his post at the treasury. Returning to power as a war minister, he exerted all the energy of his character to render the contest successful, and found means to engage the two great military powers of Russia and Austria in a new coalition, which was dissolved by the battle of Austerlitz. Pitt, whose state of health was previously declining, was sensibly affected by this event; and his constitution, weakened by a hereditary gout, and injured by a too liberal use of wine by way of stimulant, rapidly yielded to the joint attack of disease and anxiety. The parliamentary attack upon his old associate, Lord Melville (see DUNDAS), not wholly parried either by ministerial influence or the merits of the case, is thought to have deeply wounded his feelings, and completed his mental depression. A state of extreme debility ensued, which terminated in death, encountered with great calmness and resignation, January 23, 1806.

It is generally conceded that the genius of Pitt was better adapted to the regulative process of peaceable and domestic government than to the arrangement and conduct of those warlike operations which his policy entailed upon the country. At the same time it must be confessed that he had to encounter overwhelming energies—the result of a social crisis of most extraordinary character. If, therefore, he can be acquitted of a want of foresight in volunteering such a conflict, the result of the warfare, in establishing French ascendancy on the Continent, may be regarded as the effect of causes which no abilities could have controlled. To some extent he was, perhaps, more the man of expediency than of principle. In the outset of his career he was a warm advocate of parliamentary reform, but he soon abandoned the cause. He spoke and voted in favour of the abolition of the slave-trade; but although supported by the voice of a decided national majority, he would not make a ministerial measure of it, as was done without difficulty by his immediate successor; nor can we trace any decided social amelioration to his influence. As a financier he was expert in practice rather than scientifically grounded, while the waste and profusion of his warlike expenditure were extreme, and will long be felt in their consequences. Love of power was his ruling passion, and he was altogether above the meanness of avarice, his personal disinterestedness being extreme. His eloquence, if not more elevated or profound, was, upon the whole, more correct than that of any other orator of his time, and his language was remarkably copious and well arranged. Although neither illuminated by the flashes of genius which characterized his father's oratory, nor by the imagination which distinguished the eloquence of Burke, it was more uniformly just and impressive than that of either; while the indignant severity and keenness of his sarcasm were unequalled. On the whole Pitt was a minister of commanding powers. A public funeral was decreed by Parliament, and a grant of £40,000 to pay his debts. See Lord Stanhope's *Life of Pitt* (London, 1861–62, three vols.), Walford's *William Pitt: a Biography* (1890), and Lord Rosebery's little work (1891).

PITTACUS, one of the so-called seven wise men of Greece, born about B.C. 652 at Mitylene, in the island of Lesbos. He was highly celebrated as a

warrior, a statesman, a philosopher, and a poet. In 559 the citizens raised him to the dictatorship, an office which he sagaciously filled for ten years, when he voluntarily resigned it. After other ten years spent in honoured retirement he died at an advanced age in 569. Many of the stories told about Pittacus, all of which tend to show his contented and unostentatious disposition, are doubtless apocryphal. It is said that he refused a number of costly presents from Croesus, with the remark that he had already twice as much wealth as he used. Two of the maxims ascribed to him are 'know the fitting moment,' and 'it is a misfortune to be eminent.' Of his 600 didactic verses only four have been preserved; the genuineness of his letter to Croesus, still extant, is doubted by many authorities.

PITTSBURG, a city of the United States, in Pennsylvania, in Allegheny county, 223 miles north-west of Washington, advantageously situated at the central point of the large and valuable coal-fields of Western Pennsylvania, in the angle traced by the Monongahela and the Allegheny in uniting to form the Ohio. It is situated on the great Pennsylvania trunk lines of railway from the east to the west, and is connected by branch lines with several other trunk lines of the country. Great transportation facilities result from the concentration of numerous railway lines, and the union of the rivers at whose junction it is situated. The site is naturally rich in picturesque beauty, the hills and rising grounds around affording many attractive scenes. Till the recent general use of natural gas, obtained from subterranean reservoirs, it was extremely smoky. Pittsburg consists of the town proper and of several large suburbs, with which, when on the opposite sides of the rivers, the connection is kept up by fifteen bridges, comprising some of the finest specimens of iron suspension-bridge architecture ever constructed. The city itself is irregularly triangular in form, and has in a great measure been laid out in separate systems of streets corresponding to the divergence of the rivers and the form of the hills over which it extends. Many of the streets have a respectable and even handsome appearance, while there are numerous splendid suburban residences surrounded by ample and attractive grounds. Of the adjacent places which, though separately incorporated, are properly regarded as only suburbs of Pittsburg, the most important is Allegheny, on the right bank of the Allegheny river. Allegheny vies with Pittsburg in its public edifices, and also in the elegance of its private mansions, which, often occupying airy and commanding positions, have been selected for residence by the wealthier citizens. Among the public edifices in the town proper there are a great number of churches, few of them having great architectural merit except the Roman Catholic Cathedral, the Trinity Episcopalian Church, the German Lutheran, and the First and Third Presbyterian Churches. The finest buildings are the court-house, consisting of a handsome Gothic structure with a tower; the new United States court and post-office buildings, the city-hall, the Carnegie Library, and the Exposition building. Other buildings or objects of note are the banks and hotels, three large hospitals, four denominational seminaries (Catholic and Protestant), and the state penitentiary in Allegheny.

Pittsburg has almost inexhaustible sources of prosperity both in its manufactures and its trade. Its coal-seams, situated generally above the level of the rivers and torrents, are easily worked by means of adits, without deep sinkings or expensive drainage; while its rivers and railways bring it into immediate communication with the great commercial emporiums of the east, west, and south. Its industrial establish-

ments include numerous blast-furnaces, rolling-mills, foundries, glass-works, breweries, &c. In addition to these are extensive factories in which articles in iron and steel are produced, white-lead and soda-ash works, copper-smelting furnaces, copper rolling-mills, &c. In each of the staples of iron, steel, and glass it is the principal producing centre of America; and the total of coal and coke produced by its capitalists in West Pennsylvania is also larger than that of any other city in the union. The chief articles of export are petroleum, coals, iron, ironmongery, leather, tobacco, malt liquors, &c. The natural gas obtained from borings in the surrounding district is now almost universal in dwelling-houses, warehouses, and industrial establishments. Pittsburg occupies the site of a fort called Duquesne, which was built by the French in 1754, and was used by them as a central point from which, in conjunction with the Indians, they spread terror among the frontier settlements of Pennsylvania. In an attack on this fort in 1755 the British were defeated, with the loss of their commander, General Braddock. The fort was captured by the British under the leadership of Washington in 1758, and named after William Pitt. For some time Pittsburg made little progress, and in 1775 did not contain more than thirty dwellings within its present city limits. Its first great start was made in 1811, on the introduction of steam navigation; but it can hardly be said to have entered on its full career of prosperity till the opening of its rich field of coal and iron. It was chartered in 1816, and was nearly destroyed by fire in 1845. Population (1870), 86,076; (1890), 238,617, not including Allegheny, whose population was 105,287; (1900), Pittsburg 321,616, Allegheny 129,896.

PITTSFIELD, a flourishing city of the United States, Massachusetts, in Berkshire county, on the frontiers of New York, about 151 miles west of Boston by rail, in a wide valley between the Taconic and Green Mountains, at the confluence of the Pontoonuc and Housatonic. It is well built, and near its centre is a square with an area of about 4 acres. Pittsfield contains the Berkshire Medical Institution, which, as a medical school, enjoys a high reputation, and occupies a handsome and commodious range of buildings. The manufactures are very extensive, and include cotton and woollen goods, silk, castings, machinery, tools, paper, boots and shoes, brewery products, &c. Great numbers of summer visitors are attracted to Pittsfield. Pop (1880), 13,364; (1890), 17,281.

PITYRIASIS, a chronic, non-contagious, superficial affection of the skin, attended by the production of minute white scales, frequently on patches of irregular form, and of a light or dull red colour. It may occur on any part of the body (rarely over the general surface), and gives rise to itching, tingling, or pricking sensations. The scales are thrown off as soon as they are produced, and are renewed as fast as they are lost. It occurs most frequently on the scalp, when it is popularly known as dandriff. The itching attending the irritation is often annoying, causing the patient to scratch the part and loosen showers of scurf, which fall on the clothes in the form of a white mealy powder. Slight cases are easily cured by the frequent use of the warm bath, but should they prove obstinate the hair must be cut as short as possible, and the scales softened by poultices and the vapour-bath, the latter being continued for some time and alternated with alkaline or emollient lotions. At the same time the bowels should be freely evacuated, the abdominal secretions and excretions duly promoted, and the cutaneous exhalations increased by means of purgatives, alteratives, and cooling diaphoretics. The stomach should never be overloaded, and animal food sparingly partaken of.

PIU, an Italian word signifying more, and used in musical scores to intensify another adverb, as *più presto*, more quickly, *più piano*, more softly, *più tosto allegro*, rather more briskly.

PIUS II., originally called **ÆNEAS SYLVIVS PICCOLOMINI**, was descended from one of the most illustrious Tuscan families, and was born in 1405 at Corsignano, in the Duchy of Siena. In 1428 he was sent to the University of Siena, where he applied himself with ardour to the study of belles-lettres, and published several Latin and Italian poems, which met with great applause. He afterwards diligently studied civil law, and in 1431 his learning and accomplishments recommended him to Cardinal Capranica, whom he accompanied to the Council of Basel in the capacity of secretary. He soon gained the confidence of the fathers by the zeal with which he espoused their cause against Pope Eugenius IV. and the many learned speeches which he made to prove the superiority of general councils over the bishops of Rome. He was therefore made secretary to the council, and was subsequently employed on various missions of great importance. On the election of the anti-pope Felix V. by the Council of Basel Piccolomini was made Papal secretary, but having been sent on an embassy to Frederick III. of Germany he was induced to take office in the imperial court. When the emperor embraced a neutrality between the Council of Basel and Eugenius, Piccolomini, notwithstanding the active part he had taken among the fathers, followed his master's example, and was afterwards chosen as the imperial ambassador in a diet at Ratibon, where the means of putting an end to the schism in the church were taken into consideration. At length he was sent by Frederick, about the end of 1436, to negotiate the submission of Germany to Eugenius, and availed himself of this opportunity to condemn his own past conduct and to implore the forgiveness and favour of his holiness. This request Eugenius readily complied with. By the succeeding pope, Nicholas V., Piccolomini was made Bishop of Trieste, and in 1456 was raised to the cardinalate by Calixtus III. Upon the death of this pontiff Æneas was unanimously elected to fill the Papal chair, and at his coronation he assumed the name of Pius II. One of the first measures of his government was an attempt to unite the Christian princes to drive the Turks out of Europe, but the scheme fell to the ground. In 1460 he published a bull condemning the doctrine he had in former years so vigorously defended—the superiority of a general council to the pope—and forbidding all appeals to such councils under the severest penalties. He died 14th August, 1464. Pius II. was one of the most learned men of his age, and left behind him several historical works and dissertations of considerable value, together with a collection of extremely interesting letters, characteristic both of the writer and his age.

PIUS IV. (**GIOVANNI ANGELO MEDICI**) was born at Milan in 1499. He went to Rome in early life, and rapidly rose into the favour of the successive popes Clement VII., Paul III. (who made him a cardinal), Julius III., and Paul IV., whom he succeeded in 1559. One of the first acts of his pontificate was the execution of the Caraffas, brother and nephews of his predecessor, for their insolence, rapacity, and notorious crimes. Under his government the deliberations of the Council of Trent were brought to a close, and the duty devolved upon him of issuing in 1563 a bull confirmatory of its decrees. The Tridentine Creed, sometimes known as that of Pius IV., was issued by him as an embodiment of all the doctrines defined in the Council of Trent. He died in 1565. He was succeeded by Pius V.

PIUS V. (**MICHELE GIULIENI**) was born of obscure parents in 1504 at Bosco, a small town near Alessandria. At the age of fourteen he entered the Dominican convent at Voghera. He was raised to the cardinalate by Paul IV. in 1557, and about the same time was appointed inquisitor in Lombardy. He subsequently became inquisitor general—an office which he exercised with rigour against the Reformation. On the death of Pius IV. in 1565 he was chosen to succeed him, and immediately set about effecting reforms both in morals and discipline. He excited terror in Italy by the seizures, imprisonment, and burning of those convicted or suspected of heresy, among whom were several persons of note. In 1568 he sent a large body of troops to assist Charles IX. of France in his war against his Protestant subjects; and the same year renewed the bull In Cœna Domini (which see). He enforced the authority of the Index Expurgatorius, and expelled the Jews from all parts of the Papal States excepting the cities of Rome and Ancona. In 1570 he excommunicated Elizabeth of England. He lent his influence and assistance to the Venetians and the Spaniards in their war against the Turks, which ended in the memorable victory of Lepanto (September, 1571). He died on the 1st of May, 1572. He was canonized by Clement XI. on 24th May, 1712.

PIUS VI., whose secular name was **GIOVANNI ANGELO BRASCHI**, was born at Cesena, in 1717. He was appointed secretary to Benedict XIV., filled several important offices under Clement XIII., and was raised to the cardinalate by Clement XIV. On the death of that pontiff, in 1775, he succeeded to the Papal throne, and shortly after made a reformation in the financial department, and also improved the museum of the Vatican. But the greatest of his undertakings were the draining of the Pontine Marshes, the improvement of the port of Ancona, and the embellishment of Rome. While, however, this pontiff was successful in his domestic administration, he had the mortification to witness the absolute decay of the temporal power of the holy see, largely the result of the French revolution. In 1791 he lost Avignon and the county of Venaissin, which were reunited to France. In the first coalition against France the pope ranged himself among the enemies of the republic. In January, 1793, Basseville, the French secretary of legation, was massacred during a popular commotion at Rome; accordingly, after the victories of Bonaparte in Italy, in 1796, General Augereau marched into the territories of the pope, who, unable to resist, was glad to accept an armistice, which was signed at Bologna, June 13th. The pope having renewed hostilities, Bonaparte attacked and beat his troops at Senio, February 2, 1797, and proceeded towards Rome. He stopped, however, to treat with ministers sent by his holiness, and February 19 was signed the Treaty of Tolentino, by which the pope lost Romagna, Bologna, and Ferrara. December 28, 1797, in consequence of another commotion, in which General Duphot was killed, Joseph Bonaparte, the French ambassador, quitted Rome. An army, commanded by General Berthier, entered that capital February 10, 1798, and on the 15th proclaimed the establishment of the Roman Republic, governed by consuls, a senate, and a tribunate. The pope, after this deprivation of his authority, was conveyed to France as a prisoner, and died at Valence, August 29, 1799. In 1802 his body was removed to Rome, and solemnly interred.

PIUS VII. (**GREGORIO BARNABA CHIARAMONTI**) was born at Cesena in 1742, and at the age of sixteen was received into the order of Benedictines. After serving as teacher in several abbeys he became professor of philosophy in Parma, and subsequently

of theology in Rome, where his fellow-townsmen, Pius VI., created him Bishop of Tivoli, and in 1785 cardinal and Bishop of Imola. He was chosen to fill the Papal chair, March 14, 1800. His domestic administration was conducted with a rigorous economy and a wise policy in the encouragement of commerce and manufactures. In 1801 he concluded a concordat with France, by which he regained a limited supremacy over the Gallican Church. In 1804 he complied with the invitation of Napoleon to be present at his coronation, and perform the ceremony of consecration; but the emperor crowned himself and the empress with his own hands. The reforms of Joseph in Naples, and the secularizations in Germany, were sources of mortification to Pius; and having offended Napoleon by refusing to recognize his brother Joseph as king of Naples, and to shut his ports against English ships, he was obliged to witness the occupation of Rome by French troops (February 2, 1808). The Papal cities were incorporated with the Kingdom of Italy, and the firm resistance of Pius to these aggressions, and his threat of excommunicating the emperor, could not prevent Rome from sharing the same fate (May 17, 1809). June 10 and 11 the pope issued two bulls of excommunication against all violators of the Papal territory. July 6 he was arrested in his chamber by French troops, and on refusing to renounce all claims to temporal power, conducted to Grenoble, and thence to Savona. In his confinement he rejected with firmness the offers of Napoleon, and refused to confirm the bishops appointed by the latter. In 1812 he was removed to Fontainebleau, where Napoleon obliged him to accede to a new convention (January 23, 1813), by which he promised to confirm the bishops; but the emperor having, contrary to agreement, proclaimed the concordat before its completion, and issued with it a code of organic laws seriously affecting the discipline of the church on marriage, the clergy, and public worship, Pius, whose consent had been entirely conditional, refused to concur in any concordat that should not settle all disputed points. He was therefore treated as a prisoner, and it is said that he was personally abused by Napoleon. In 1814 the pope was released and restored to the possession of all the Papal territories except Avignon and Venaissin in France, and a narrow strip of land beyond the Po. Although attached to the old hierarchical policy, as appears from his bulls and briefs against the distribution of the Bible, against Catholic Switzerland, &c., yet none of his plans for restoring the old state of things, except the revival of the Jesuits, August 7, 1814, were successful. The concordats with France, Bavaria, and the Two Sicilies, and the convention with Prussia, were, however, triumphs of the policy of the Roman court. His administration, which was moderate and wise, was much indebted for its character to Cardinal Consalvi, his intimate friend and minister. He repressed with a vigorous hand the brigandage and disorder which the protracted wars had introduced, and broke up many of the secret societies which then existed, especially the Carbonari. Rome became again not only the refuge of fallen princes and proscribed families, but the seat of the fine arts. Pius VII. died in consequence of a fall, July 6, 1823, and was succeeded by Leo XII.

PIUS VIII. (FRANCESCO XAVIERO CASTiglione) was born at Cingolia, in the States of the Church, in 1759, of poor but respectable parents. He entered the church young, passed through all the orders of the hierarchy, was created cardinal by Pius VII., and on March 31, 1829, elected pope on the death of Leo XII. He died 30th November, 1830.

PIUS IX. (GIOVANNI MARIA MASTAI-FERRETTI)

was born at Sinigaglia, 13th May, 1792, and belonged to a noble but impoverished family of Lombard extraction. He was educated at the ecclesiastical college of Volterra, where he spent five or six years quitting it in 1810. Five years later he entered the Guardia Nobile of the Vatican, but he soon after adopted the ecclesiastical profession, and lived for a few years in Rome as the head of a large orphanage gaining the good-will of Pius VII., though filling no post at his court. In 1823 he was attached to the suite of Monsignor Muzi, apostolic vicar in Chili, and traversed a large portion of South America. Not long after the death, in 1823, of Pius VII. he returned to Rome, and was appointed by Leo XII. a prelate in his household, a canon in Santa Maria di Via Lata, and president of St. Michael's Hospital in Via Grande. In 1827 he was created Archbishop of Spoleto, and five years later transferred to the see of Imola. At Imola he showed himself zealous in all good works and possessed of liberal convictions, thereby acquiring great popularity, and the title of 'the Good Bishop.' He was raised to the cardinalate in December, 1840, but continued to reside in his diocese till 1846, when, on the death of Gregory XVI., he was elected pope. The new pope, in honour of his early patron, Pius VII., assumed the name of Pius IX. (Pio Nono). He ushered in his reign by a startling procedure. He liberated 2000 political offenders who had been imprisoned by his predecessors, and granted a general amnesty, restoring all prisoners and exiles to their civil rights on their signing a declaration of allegiance. He also (in 1848) drew up a scheme of representative government, with two chambers, a free press, and a national guard. These and similar measures for a brief period secured him boundless popularity. But freedom from foreign invaders was also wanted by the Italians. They wished to drive out the Austrians. The Milanese overpowered Radetzky after five days' fighting, Charles Albert led the Piedmontese to the Mincio, and the youth of all Italy rose to the rescue. But matters were now going too fast and too far for the pope, who refused to countenance the revolutionary movement, the result being that Charles Albert was overpowered in Lombardy, while Naples, Tuscany, Parma, and Modena had their newly acquired freedom quenched in blood. The pope now entirely lost the favour of the Roman populace. Threatened by the mob in his own palace he sought safety in flight, and a Roman republic was proclaimed in February, 1849, with Mazzini at its head. Louis Napoleon, president of the French Republic, having determined to restore the pope, sent an expedition to Rome under Oudinot, by whom the Italian patriots, led by Garibaldi, were overpowered. Rome surrendered on July 3d; but the pope did not return to his capital till April, 1850. After his return the government of the pope lost much of its personal character, and at the same time became entirely conservative or reactionary. He now placed his whole confidence in Antonelli, a prelate who had risen to distinction under Gregory XVI., and whom Pius himself had made a cardinal and a member of his council of state in 1847. Antonelli preserved the ascendancy in all matters of state till his death in 1876. The pope himself now bestowed his whole attention upon the church. He recalled the Jesuits, canonized saints, and defined new dogmas. The doctrine of the immaculate conception of the Virgin Mary was decreed in 1854; that of the infallibility of the pope, when speaking *ex cathedra* on a question of faith or morals, was proclaimed in the great Ecumenical Council held in the Vatican in 1870. Previous to this time the pope's temporal dominions had become sadly shrunken in extent, owing to the gradual unification of Italy under

Victor Emmanuel. (See ITALY.) The temporal power of the pope, however, was still secured by the presence of a body of French troops at Rome. But after the defeat of Napoleon III. at Sedan these were withdrawn. On the 20th of September, 1870, the Italian troops entered Rome, and the temporal power was at an end. The Vatican was left to the pope; and free diplomatic intercourse, the honours due to a sovereign, and a civil list of £129,000 yearly, were secured to him. But these he declined, and year after year he confined himself to the Vatican and its garden, declaring that he was under restraint, and a prisoner in his own palace. He died in full possession of his mental faculties on 7th February, 1878, and was succeeded by Leo XIII.

PIZARRO, FRANCISCO, the name of a celebrated Spanish adventurer, the discoverer and conqueror of Peru. His origin and early habits were sufficiently humble, he being the fruit of an illicit connection between a peasant girl and a hidalgo of Truxillo, in Estremadura, in the neighbourhood of which place he first saw the light about 1475. Receiving neither support nor countenance from his father, he was thrown entirely upon his mother's resources, who employed him as a swineherd, and left him totally illiterate. The spirit of adventure which at that period pervaded Spain induced him at length to quit his inglorious occupation, and in company with some other soldiers of fortune to seek an improvement of his condition in the newly found continent of America. He was in Hispaniola in 1510, and afterwards was connected with Balboa when the latter discovered the Pacific. After Balboa's death he attached himself to the governor Pedro Arias, and was engaged in several military expeditions. In 1515 he was one of a small company who were sent across the Isthmus of Darien to trade with the natives of the Pacific coast. He established himself near Panama when it became the capital of the Spanish dominions in this quarter, and cultivated a piece of land by the labour of slaves. Subsequently he became associated with Hernando Luque, or de Luques, a priest possessed of some money, and Diego de Almagro, an adventurer like himself, and having jointly fitted out an expedition the associates set sail from Panama on a voyage of exploration and conquest along the coast to the southward (1524). Their first voyage was unsuccessful, but they learned the existence of the rich empire of Peru, and were not long in making a second voyage, with the intention of conquering this country. Their forces were too few, however, for this object, and Pizarro determined to seek assistance in Spain. He reached Seville in 1528. After encountering tedious delays and obstacles he obtained from the queen a commission bestowing on him the right of discovery and conquest in Peru, with the rank and title of governor and captain-general of the province. Raising a small force in Spain, he recrossed the Atlantic (in 1530), and next year sailed from Panama at the head of a small force. Taking advantage of a civil war then raging in that country, the Spaniards became the allies, and eventually the enslavers of Atahualpa, or Atahualpa, as he is variously called, the reigning inca. Treacherously seizing upon the person of the monarch at a friendly banquet to which they had invited him and his whole court, they first compelled him to purchase, at an enormous price, a temporary reprieve from a death which they had determined he should eventually undergo; and having succeeded in extorting from him, it is said, a house full of the precious metals by way of ransom, after a mock trial for a pretended conspiracy, condemned him to be burned, allowing him to be first strangled, as a reward for becoming a Christian. The news of their success brought a considerable accession of

strength from Europe to the invaders; and Pizarro, in order to consolidate his empire, founded, in 1532, the city of Lima, which he intended as the capital of his possessions; but the discord which had long existed between Almagro and Pizarro at last broke out into open violence, and in the struggle which ensued Almagro, now in his seventy-fifth year, was defeated, taken prisoner, and strangled, by Hernando Pizarro, brother to the general. This catastrophe, which took place in 1537, was avenged four years afterwards by the son of the victim, and bearing the same name, who having organized a conspiracy against the destroyers of his father, broke into the palace at Lima, and after an obstinate resistance succeeded in despatching Francisco Pizarro, 26th June, 1541. It is impossible to refuse to this adventurer the credit of considerable military as well as political talent, though the one was sullied by his extreme barbarity, the other by his perfidy and heartless dissimulation.

PIZARRO, GONZALO, brother of the preceding by the same father, but another mother, and also illegitimate, was born at Truxillo in 1502. He accompanied his brother on his second visit to Peru in 1531. In early life he had signally distinguished himself as a soldier, and when he reached the New World he was acknowledged to be the best lance in Peru. His talents were exclusively those of a guerrilla chief, as he wanted the military and civil capacity of his elder brother. In 1540 he was appointed by Francisco governor of Quito, and he was directed to undertake an expedition towards the east, where a land supposed to be extremely rich in spices was reported to lie. At the head of 350 Spaniards and 4000 Indian auxiliaries he set out on the expedition across the Andes, which resulted in the discovery of the head-waters of the Amazon, and the descent of that stream to the ocean by Francisco de Orellano, one of his officers. The expedition occupied two years, and so thinned the ranks of the adventurers by its hardships that only eighty Spaniards and the half of the Indians returned to Quito. After the assassination of Francisco, Gonzalo raised an army and advanced upon Lima to attack Blasco Nuñez, the new and unpopular viceroy sent out from Spain. He was warmly supported by the bulk of the colonists and many of the royal troops. On the 18th January, 1546, a battle took place near Quito, in which Nuñez was defeated and slain. But in the following year Pizarro was attacked by an army sent from Spain, and was eventually defeated, taken prisoner, and beheaded (1548).

PIZZICATO (Italian, contracted pizz.), an expression frequently met with in music for instruments of the violin kind, signifying that the notes over which it is placed are not to be played by the bow, but by twitching the strings with the fingers. The pizzicato is often employed in accompaniments, and has a piquant guitar-like effect. On the violoncello pizzicato passages have a grave, melancholy, and even pathetic effect, and are occasionally met with in the symphonies of Beethoven and the operas of Meyerbeer.

PLACE, LA. See LAPLACE.

PLACENTA, or 'AFTER-BIRTH,' the structure which, in the higher Mammalia, connects the fetus, or unborn embryo, with the circulation of the mother, and thus provides for its due nutrition, and for its respiration also. In its most typical form it is only met with in the development of the higher Mammalia, but certain analogous structures appear to exist in connection with the development of some species of Sharks and Dog-fishes. The human placenta presents us with the most perfect type of this structure. After impregnation and gestation have been fulfilled and inaugurated the upper or super-

sical layer of the mucous or lining membrane of the human womb grows thicker, becomes more vascular, and thus forms the membrane known as the *decidua*. As development proceeds, and at a very early stage in its history, the decidua exhibits a threefold division. The layer immediately lining the uterine cavity is termed the *decidua vera*, this name being given to it by Dr. W. Hunter; the portion which directly covers the embryo or ovum is named the *decidua reflexa*; whilst the part of the membrane on which the ovum rests, and which intervenes between it and the muscular wall of the womb, is called the *decidua serotina*. This third layer is to be regarded as a special growth of part of the decidua vera, and it is developed in especial connection with certain processes, or villi, which are developed from the chorion. The chorion is the covering which directly invests the egg or embryo itself. The decidua reflexa is also to be considered as developed from the decidua vera, and as a general outgrowth of that membrane.

The villi of the chorion are at first loosely and superficially imbedded in the decidua serotina; but ultimately they disappear from every other portion of the chorionic surface, and become greatly and especially developed at the point of attachment of the ovum to the decidua. The embryo becomes thus fixed and attached to the uterine walls; and as development proceeds blood-vessels appear within the villi, these vessels being formed from the inner layer of the chorion, or *endochorion*, as it has been termed. These blood-vessels, by their gradual enlargement and interlacing with each other, together with the increase of the underlying decidua, form the mass or bulk of the future placenta. The mucous membrane of the womb itself, in the neighbourhood and at the site of the placental development, is meanwhile being traversed in its deeper layer by blood-vessels, consisting of arteries and veins, which carry blood to and return it from the placenta. Then also the decidua next the uterus and furthest from the chorion and ovum become excavated or cellular in structure, and show numerous spaces, termed *sinuses*, into which the arteries and veins of the uterine membrane open. The villi of the chorion penetrate into these sinuses, the wall of the sinus being pushed before the villi. In this manner the villi and the blood of the uterine arteries and veins contained in the sinuses are brought into contact. This, at least, is one view of the mode in which the blood-vessels of the mother are brought into relation with those of the fœtus or embryo—the question whether *direct* vascular communication between the placenta and uterus exists being one of much interest, and which has been variously debated by physiologists. The Hunters and others believed in the existence of placento-uterine vessels, and that the maternal and fetal systems were in communication indirectly—the maternal blood being sent into the decidua membrane and sinuses, and the placental tufts dipping into these uterine sinuses. This view, corresponding with that just stated, is the opinion mostly adhered to by the physiologists of the present day.

The fully-formed human placenta consists, therefore, of a fetal or embryonic part, and of a maternal portion, the former consisting of structures developed by the embryo, the latter of structures formed from the tissues of the mother. At the end of pregnancy it attains a thickness of about 1 or 1½ inch, its diameter being 6 or 8 inches, and its circumference 18 to 24. In man it is therefore of a rounded or 'discoidal' shape, and more rarely bilobular or multilobular in general form. Its internal surface is smooth and covered by the amnion and chorion, and beneath these membranes the umbilical vessels may

readily be traced. The chorion is directly attached to the internal surface of the placenta, and processes of this membrane dip down between the lobes and lobules into which its substance is divided. The amnion is more loosely attached over the chorion. The outer or uterine surface of the placenta, or that by which it is attached to the walls of the uterus, is somewhat roughened and covered by the decidua serotina. It is uniform and level, and the lobes or divisions of the placenta are more plainly visible when the decidua serotina is stripped off. Processes of the decidua dip down between the lobes on this surface, as the chorion did on the inner surface. The vessels forming the lobes of the structure do not appear to anastomose or unite with those of neighbouring lobes.

At birth, or rather during the process of parturition, the connection between the wall of the uterus and these placental structures being severed by the uterine contractions, the placenta is thrown off as the 'after-birth,' after the child itself has been expelled. This structure in man, from its maternal portion being cast off at birth, is called *caducous* or *deciduate*; or, from the degree of union formed between the maternal and fetal parts, it is termed a *coherent* placenta. In the Pig and in other groups of Mammalia, to be presently noted, the placental structure differs in important respects from its type in man. In these forms no decidua membranes exist, the lining membrane of the uterus merely exhibiting a greater vascularity, but without developing into distinct decidua layers. The chorionic villi of the embryo attach themselves directly to the lining membrane of the uterus, and the villi are further developed uniformly and universally over the surface of the chorion—save at the poles—and are not restricted to one portion, as in man. At birth, in this latter case, therefore, no maternal parts or structures of the mother are cast off, the villi of the fetal membranes being simply withdrawn from the fossæ or depressions in the uterine walls. The placenta in the latter case is therefore said to be *non-deciduate*, or *non-caducous*, or *incoherent*, in opposition to the characters seen in the placentation of man.

On surveying the higher Mammalia variations in the mere form of the placenta may be discerned as resulting from deviations in structural development. The Quadrumana, Bats, Insectivora, and Rodents possess, like man, a cake-like or 'discoidal' placenta. In Carnivora the placenta encircles the embryo like a zone or belt, and is hence termed 'zonary.' In Ruminants the placenta consists of detached lobes or *cotyledons*, each consisting of a group of vascular chorionic villi, which are either convex, and are received into cups on the uterine surface (as in the Sheep), or concave, and fit convexities of the uterus (as in the Cow). In the Pig, Horse, Camel, &c., and in Cetacea, the villi of the chorion present a scattered disposition, the placenta in such a case being termed 'diffuse.'

The orders Bimana (Man), Quadrumana (Apes, &c.), Insectivora (Shrews, Hedgehogs, &c.), Cheloptera (Bats), and Rodentia (Rats, Mice, Hares, Porcupines, &c.) possess a deciduate discoidal placenta. The Carnivora (Lions, Dogs, &c.), Proboscidea (Elephants), Hyracoida (Hyrax), possess a deciduate zonary placenta. The Ungulata, or Hoofed Quadrumana (Horse, Rhinoceros, Tapir, Hippopotamus, Pig, Ruminants, &c.) possess a non-deciduate placenta, which is either 'diffuse' or 'cotyledonary.' The Cetacea possess a placenta agreeing in structure with that of the Ungulata. The placentation of the Sirenia (Dugongs and Manatees) is unknown; analogy, however, would lead us to conclude that the placenta of these forms agrees in form and structure with that of the Cetacea. In the order Edentata, represented by Sloths, Armadillos, Ant-eaters, Fan-

golina, &c., the placentation varies, it being found sometimes (as in *Manis*) to be diffuse and non-deciduate; in the Sloths, to be cotyledonous (non-deciduate?); and in *Orycteropus* or the Cape Ant-eater, to be deciduate and discoidal. (In a recent memoir by Professor Turner of Edinburgh, published in the Transactions of the Royal Society of Edinburgh, vol. xxvii., the placentation of the Two-toed Sloth (*Cholepus Hoffmanni*) is shown to approach closely to that of man and those deciduate mammals possessing a discoidal placenta. The placenta is therefore discoid in shape, and maternal structures are thrown off at birth along with the fetal membranes.)

The functions of the more perfect placenta, or its analogues in lower forms, are clearly those of establishing a communication between the blood or vascular systems of the mother and the embryo, with a view to the due nutrition of the latter. It is this connection, in its relation to the longer period of gestation in viviparous animals, which gives to such forms their high reproductive characters. A continual inflow of maternal and of foetal blood is continually taking place in the placental structures; the streams, however, remaining distinct and separate, although through the thin membranous walls of the blood-vessels separating the two currents an interchange of materials is perfectly established. New and fresh nutritive matter is thus conveyed to the foetus, whilst the effete products of the embryo are in turn excreted through the maternal system.

PLACENTA, in botany, a development of cellular tissue formed at some point of the inner side of a carpel, to which the ovules are attached either immediately or by umbilical cords. The part of the carpel where the placenta is formed is the inner or ventral suture, corresponding to the margin of the folded carpellary leaf; while the outer or dorsal suture corresponds to the midrib of the carpellary leaf; the placenta is hence sometimes called marginal. The placenta is formed on each margin of the carpel, and is therefore essentially double. When the pistil is formed by one carpel the inner margins unite in the axis, and usually form a common placenta, which may extend along the whole margin of the ovary as far as the base of the style, or it may be confined to the base or apex only. When the pistil is apocarpous (that is, composed of several separate carpels) there are generally separate placentas at each of their margins. In a syncarpous pistil, on the other hand, the carpels are so united that the edges of each of the contiguous ones by their union form a *septum* or *diseppiment*, and the number of these septa consequently indicates the number of carpels in the compound pistil. When the diseppiments extend to the centre or axis the ovary is divided into cells or loculements, and may be bilocular, trilocular, or multilocular, according as it is formed by two, three, or many carpels, each corresponding to a single cell. In these cases the marginal placentas meet in the axis, and unite so as to form a single central one. Some call this placentation *axile*, but this term is perhaps properly restricted to cases where the placenta is an actual prolongation of the axis. When the carpels in a syncarpous pistil do not fold inwards completely so as to meet in the centre, but only partially, so that the diseppiments appear as projections on the walls of the ovary, then the ovary is unilocular, and the placentas are *parietal*. This distinction of axile and parietal is of great importance, as characterizing different natural orders.

PLACET, or PLACITUM REGIUM, the right belonging to the governing body of a state to be informed of all important ecclesiastical regulations and alterations, and give their sanction thereto, or withhold it

if the interests of the state demand it. In European history we find this right most frequently exercised in connection with Papal bulls, briefs, or other instruments which were obnoxious to the government of the country or opposed to the spirit of its laws. It is well known that in virtue of their position and the support they gave to the church the early Christian emperors claimed the privilege of legislating on ecclesiastical matters; and during the middle ages the popes had frequent cause for complaint that their free intercourse with their churches was considerably restricted by the sovereigns of several countries. It was laid down as a principle in the treaties of Westphalia (24th October, 1648) that the will of the sovereign of the state is supreme and final within his own territory in all matters of religion. This claim was enforced by the governments of Prussia, Baden, Saxony, Wurtemberg, Saxe-Gotha, Saxe-Weimar, and other German Protestant and Catholic states; but was pressed most stringently by Joseph II. of Austria, who rigorously forbade the publication of all Papal bulls, briefs, and constitutions, and all the ordinances of the local bishops, until they had been subjected to his revision. These claims have been naturally obnoxious to the Roman see, and have been and still are the cause of much serious dispute in Germany.

PLACOID SCALES, a variety of scales covering the bodies of the Elasmobranchiate fishes (Sharks, Skates, Rays, &c.) These structures generally consist of detached bony plates or grains, not set closely together, but disposed in a scattered or irregular manner over the skin of these fishes. The larger or plate-like placoid scales generally possess a spine which rises from the centre of the scale, such a structure being well seen, for example, in the Thornback Ray (*Raja clavata*). Professor Agassiz, who proposed to classify fishes by means of the form of their scales, gave to the Elasmobranchii the name *Placoidei*, from the nature of the body-covering. Placoid tubercles occur in a fossil state in the Upper Silurian rocks, these epidermal fossils being referred to the genera *Thelodus* and *Sphagodus*, which form the earliest known examples of Plagiostomous fishes. (See FLAGIOSTOMI.)

PLAGAL, in music, the name given by Gregory the Great to the four collateral scales which he added to the four authentic scales of Ambrose. (See GREGORIAN TONES.) The term plagal is now applied to melodies in which the principal notes lie between the fifth of the key and its octave. The plagal cadence consists of the chord of the subdominant followed by that of the tonic. See MUSIC.

PLAGIARISM. See PLAGIUM.

PLAGIOSTOMI, a sub-order of fishes of the order Elasmobranchii. The Plagiostomi ('transverse-mouthed') are represented by the Sharks, Rays, and Skates; the sub-order being distinguished by the bodies of the vertebræ being either bony or at any rate containing osseous elements. The skull is of gristly or cartilaginous material, and does not show a division into separate and distinct cranial bones. The mouth exists in the form of a transverse slit, and is situated on the under surface of the head. No swimming-bladder exists in this group of fishes. The scales are of the 'placoid' variety. (See PLACOID SCALES.) No operculum or gill-cover is present, but the gills (which in all Elasmobranchii exist in the form of pouch-like structures) open each by a distinct cleft. In addition to the external apertures of the gill-sacs, two tubes opening on the upper aspect of the head by two apertures termed 'spiracles,' and which lead into the pharynx or back part of the mouth, convey water to the breathing organs. The teeth are generally numerous in Plagiostomous fishes,

and the palato-quadrate and suspensorial cartilages are separate and move upon the skull. The Plagiostomi include three groups. The Cestrarhynchi, represented solely by the *Cestracion Phillipi* or Port-Jackson Shark, possess a prominent spine in front of each dorsal fin; the hinder teeth are obtusely shaped; the teeth are arranged upon the jaws in a tessellated or pavement-like manner; and by means of this dental apparatus the Molluscs and Crustaceans on which this form feeds are crushed and broken up. The Selachii, forming the second group, include the Sharks and Dog-fishes. These forms are distinguished by the branchial apertures or gill-openings being situated on the sides of the neck. The pectoral fins are placed, as in the generality of fishes, on the breast; and the body is of elongated shape. The last group of Plagiostomous fishes is that of the Batides, represented by the Skates, Rays, and Saw-fishes, in which the gill apertures exist on the ventral or lower surface of the body behind the mouth. The body is flattened from above downwards, its great breadth being produced by the large size of the pectoral or breast fins, which meet in front. The tail is of slender conformation, and usually possesses two or more dorsal fins, whilst it may bear spinous processes of various kinds. The mouth is provided with flat rhomboidal teeth; the eyes and spiracles are borne on the upper aspect of the head, the nostrils being situated on the ventral surface with the mouth and gill apertures. See also SAW-FISH, SHARK, SKATE, RAY, &c.

PLAGIUM, in the Roman law, is the crime of stealing the slave of another, or of kidnapping a free person in order to make him a slave. According to German law it is the getting forcible possession of a man's person, so as to restrain him of his liberty. By Scotch law the crime of stealing an adult person (*plagii crimen*) was punishable with death, and the same punishment has been applied to the stealing of children. The word has given origin to the term *plagiarism*, used for the act of stealing the thoughts and words of another by publishing them as one's own. Plagiarism, though often practised, is not seldom charged where there has been mere coincidence in thought or expression, since the most striking figures, for instance, are those most likely to suggest themselves to a variety of persons. The idea of raising all the roofs of a city and looking into the interior of the houses, used by Quevedo and Le Sage might easily occur to a person unacquainted with their works. Such repetitions of course become more and more likely in proportion as the number of books and educated men increases.

PLAGUE, a disease characterized by great prostration of the strength, and certain local symptoms, as buboes (swellings of glands in the groins, armpits, and angles of jaws), carbuncles, and livid spots (*petechiæ*). The former appear from the second to the fourth day of the disease, and previous to their appearance the patient suffers from lassitude, aching pains in the forehead, back, and limbs, shiverings and fever. Accompanying the fever there is severe headache, and also delirium or stupor. The eyes are red, the skin hot, the tongue black, dry, and cracked, or as if coated with cotton wool, crusts form on the teeth and lips, and there is intense thirst. The glandular swellings cause great pain, and, if the patient survive long enough, they suppurate. Sickness and vomiting of bilious matter, and also altered blood (coffee-grounds vomit) are not uncommon. 'Constipation is the rule in the acute stages of the disease. It is sometimes followed by diarrhoea, which has been regarded as a favourable sign.' The aspect of the patient is peculiar. He wears a dull, stupefied, haggard look—the countenance of the plague-

stricken expresses apathy. Sometimes the onset of the disease is marked by this peculiar state of mental apathy, in which the patient has a 'lost' or 'absent' or 'wandered' look and strange staggering gait.' Sometimes a sudden dread seems to take possession of the patient, and it is accompanied by great restlessness; sometimes sudden intense pain in the glands is the first symptom. Death in many cases takes place on the first day, and frequently in a few hours after the appearance, but sometimes not till the second, third, or even fifth day. It is considered favourable if the buboes terminate in suppuration; while 'all cases complicated with nervous, hæmorrhagic, or bilious manifestations end fatally.'

In regard to the origin of the plague, and the manner in which it is communicated, very different opinions have been entertained, according to the state of medical science. In early times, when calamitous events, the causes of which were not understood, were attributed to spirits and demons, the plague was also ascribed to their influence. At a later period it was accounted for by changes in the air, by poisonous vapours which descended from the atmosphere, or was attributed to clouds of insects which were received into the body by inspiration, or in the food, or by absorption through the skin, and thus corrupted the blood. There are certain conditions which have always attended outbreaks of the plague. The chief of these are unwholesome and insufficient food, overcrowding, bad ventilation, accumulation in the neighbourhood of dwellings of decaying animal and vegetable refuse. In short, these conditions may be summed up in the words, 'poverty and bad sanitation.'

The plague is a specific disease, and is communicable from one person to another mainly by breathing the contaminated atmosphere surrounding the sick; but it is also carried by clothing, and the disease can be communicated by inoculation. Breathing the air of the sick-room for some time is the most certain method of communication, as is evidenced by the fact that when the disease enters a house all the inmates are usually attacked by it, while a person meeting one of the household outside runs little risk. The infection seems to be readily destroyed by free access of fresh air. It appears to be unknown within the tropics, and the cold weather of northern latitudes has been observed to check its advance. In Europe the late summer and autumn months have been marked by its deadliest ravages. It is endemic in certain localities of Asia (parts of Mesopotamia, India, China), and when it has appeared in Europe it seems always to have been traced to the East. It has often been carried by ships, no doubt by one or other of the crew being infected, and not by the merchandise. There is no specific treatment. The general line of treatment is thus summarized by a recent writer: 'Most important of all perhaps, is the exposure of the patient to abundant, freely changing air; next is the use of cold or tepid sponging, as the temperature of the body and the state of the skin (as well as the sensations of the patient, if he be sensible) may seem to call for; together with the large administration of drinks (acid or other) to combat the thirst, the judicious use of liquid food, and especially of stimulants, when the dropping of the pulse, the coolness of the skin, and the weak condition of the patient call for them.'

There is little doubt that the plague appeared in the most ancient times, particularly where a numerous population was crowded together in the warm climates; but we must not consider every disease as the plague which has been so called by historians, as they often mean by the term nothing more than a malignant disorder prevailing over a considerable

extent of country. Among the most famous instances is the plague described in so masterly a manner by Thucydides, which, in the second year of the Peloponnesian war (430 B.C.), ravaged Athens, then besieged by the Spartans. A large number of the inhabitants of Attica had fled into the city. Fear, anxiety, want, or badness of provision, and the corruption of the air caused by the crowded state of the population, produced and propagated the disease in the city. Death generally ensued on the seventh or ninth day. This epidemic does not seem to have been the real oriental plague, however, any more than that which prevailed in Jerusalem (A.D. 72) when it was besieged by the Romans, as described by Josephus. In Rome the plague existed (A.D. 77) in the reign of Vespasian; of Marcus Aurelius (170), when it raged over almost all Europe and Asia (but this was probably not the real plague); of Commodus (in 189); and particularly of Gallienus (in 262), when 5000 persons are said to have died daily in Rome. In Constantinople, in the reign of Justinian (in 544), it raged so violently that 1000 grave-diggers are said to have been insufficient for the interment of the dead. This terrible plague continued its ravages for fifty years with but short intervals. In 565 it appeared under the name of *pestis inguinaria* in Trèves; in 588 in Marseilles. From the descriptions of this visitation given by contemporary writers it was evidently the true oriental plague, and it had spread over Egypt before reaching Europe. Great mortality from it resulted not only in Constantinople but also in Italy, Gaul, and other countries, including Northern Africa. In the seventh century the plague or other serious epidemic raged in Saxony; in 823 it prevailed all over Germany, and from 875 to 877 was particularly malignant in Saxony and Misnia, as was also the case in 964. In the eleventh century it broke out in Germany at least six times, mostly after or during a famine, and raged with so much violence that it was believed that all mankind was doomed to be swept away by it. This unfortunate belief prevented the taking of effectual means to check it, and apathy in suffering was considered as an act of piety. In some cases, however, the Jews were suspected of having poisoned the wells, as in a time not very remote the Hungarian peasantry suspected the nobility when the cholera swept away so many of the poorer classes. In the twelfth century the plague prevailed in Germany above twenty-five years. In the thirteenth century it was brought into Europe by the Crusaders. From 1347 to 1350 it traversed all Europe, and was then called the *Black Death*. The Black Death was carried to Europe from the East, having been transmitted, it is said, from Tartary, and ultimately from China, to the Crimea, whence it was carried to Italy by certain Genoese. It also reached Egypt and thence Northern Africa. It was communicated over great part of Europe, including Britain and Scandinavia. In England it broke out first in the west in 1348, and then spread over the rest of the country, including Ireland and Scotland; its ravages being severest in the towns. After causing an immense number of deaths it reappeared in 1361 and 1369. The Black Death was the most serious epidemic ever known to have afflicted Europe, though estimates vary as to the mortality caused by it. Some reckon that at least a fourth of the whole population of Europe, or about twenty-five millions of the inhabitants, were carried off by it from first to last. In England the proportion of deaths was much higher than this, amounting to a third, or even a half, of the whole population. Some towns lost almost all their inhabitants; in Oxford two-thirds of those connected with the educational institutions perished; in London the deaths amounted to 100,000,

in Norwich to 60,000. The mortality was naturally greatest among the lower orders, while the clergy and religious orders suffered to an equal or greater extent, no doubt from their pious efforts on behalf of their poor and suffering brethren. The name Black Death was given from the dark blotches that appeared on the skin as a special feature of the disease, others being boils or buboes and spitting or vomiting of blood. Of those attacked some died almost immediately, others within twelve hours, almost all who succumbed within three days. It appears to have been at its height in the summer of 1349. The consequences it left behind it were great and far-reaching. One was that labourers were now so scarce that wages went up to double their former rate, thus leading to the passing of acts intended to regulate them, which had little result except to stir up ill-feeling, ultimately culminating in Wat Tyler's insurrection. Another consequence was the breaking up of many estates into farms let on lease, owing to the scarcity of hired labour by which they could be cultivated under their owner's own management. A great accession to the land owned by the church was another consequence of the Black Death, which long remained a landmark in English social history. Since that time the plague has never raged with so much violence. Boccaccio, in the introduction to his *Decameron*, has given a vivid description of its physical and moral effects in Florence in 1348. In the fifteenth century it raged in Europe on several occasions, and was accompanied with dreadful sufferings. The historians of that time give terrible pictures of distress. London suffered severely both at the beginning of the century and again in 1428, while a serious outbreak took place in 1472 and subsequent years. In the sixteenth century the plague again raged, and in 1563 was introduced into England by the return of an English army from the Continent. Though some means were already taken against the plague—for instance, lazarettos built—yet it raged in Europe on various occasions and in different countries during the seventeenth century. Holland suffered from it in 1603; in the same year Egypt lost by it about a million of its inhabitants. In 1630 Milan was ravaged by it; in 1635-37 Holland again suffered; in 1656 Italy had a dreadful visitation during which 300,000 persons are said to have died in Naples, 60,000 in Genoa, but only 14,000 in Rome, owing to superior sanitary measures and precautions. On this occasion it spread also to Spain, Germany, and Holland. In 1603, 1625, 1636, and 1665 it made great ravages in England. In 1603 there are said to have been 38,000 deaths in London; in 1625, 35,000; in 1636, over 10,000; while 1665 is known as the year of the 'great plague' in London, so graphically described, with perhaps some colouring, by Defoe. During the year the deaths are given at over 68,000 out of a population estimated at 460,000. The plague on this occasion is said to have come directly from Holland and indirectly from the Levant; but the filthiness of the city, and the fact that this scourge seems to have been present in London to a greater or less extent for many years, render it unnecessary to seek for any extraneous source of the epidemic. The disease spread somewhat widely over the country both in this and the following year. The cessation of the plague in London was attributed to the great fire, and though this no doubt had its local effect, still there was a similar disappearance of the epidemic not long after this time in Western Europe. In 1679 Vienna lost 76,000 of its citizens by this scourge; in 1681 Prague lost 83,000; and various German cities suffered severely. Early in the eighteenth century the plague caused many deaths in Eastern and Cen-

tral Europe, the number in Prussia and Lithuania being set down at 283,000. On this occasion it extended its ravages into Northern Europe, Copenhagen and Stockholm having both suffered, the latter to the extent of 40,000 deaths. In Constantinople and other places in the Levant it frequently raged during this century, and in 1720-21 Marseilles and part of Southern France were ravaged by the epidemic brought from this quarter. The deaths in Marseilles alone are said to have numbered from 40,000 to 60,000; thousands of corpses lay unburied in the streets. In 1770 it raged in Moldavia, Wallachia, Poland, and other adjacent regions, and in 1771 it carried off over 40,000 persons in Moscow, or one-fourth of the whole population. During the nineteenth century it made itself felt on several occasions in Constantinople and other parts of Eastern Europe, in Asia Minor, Syria, Mesopotamia, Arabia, Persia, Egypt, and Northern Africa, but nowhere has it affected a very wide area. In 1815 it caused considerable alarm in Europe by making its appearance at Noja on the east coast of Italy, but great precautions were taken against its spreading, and it soon disappeared. In 1834-35 great mortality was caused by it in Egypt. It also carried off many thousands in Mesopotamia between 1873 and 1877. In 1878-79 the plague made its appearance on the lower Volga, where it caused a considerable number of deaths. India has often been visited by this terrible disease, and hundreds of thousands have at various times succumbed to it in that country. In September, 1896, several cases were recognized in Bombay, and during the succeeding nine months the disease raged in the city with such severity that the majority of the inhabitants fled to neighbouring towns and villages. Poona and Karachi were attacked by the end of 1896, and the disease also spread to more distant parts. A special commission of experts was appointed by the Indian government, and vigorous measures, such as house-to-house visitation, thorough disinfection, and enforced isolation, were adopted. The native municipality of Bombay was for plague purposes superseded by a plague committee. In February, 1897, an international sanitary conference regarding the plague sat at Vienna, and after discussion came to the conclusion that the disease was caused by a bacillus discovered in 1894 by Kitasato and Yersin. They also gave countenance to the view that rats, mice, and certain other animals, which were liable to attack, probably contributed largely to spread the disease. Yersin, one of the discoverers of the plague bacillus, had by that time prepared and used a serum for injection, made by the culture of bacilli in horses, and Professor Haffkine, a member of the Indian government's special commission, had met with some success in inoculations with another serum, in which the cultivated bacilli had been killed by heat. Bombay was again visited by a serious epidemic in the autumn of 1897, which reached a climax in February of the following year, when the deaths from plague numbered 250 per day. This outbreak also spread to other parts of India, especially in the Bombay presidency, but it was virtually over by June. The sanitary measures of the authorities came into collision with native beliefs and prejudices at various points, and on May 9, 1898, serious riots broke out in Bombay and elsewhere. This led the government to abandon all the more stringent and severe of their preventive measures, and the fact that no harm resulted from their action seems to justify the statement that the disease takes its own course whatever may be done. Calcutta was first visited by the plague on April 16, 1898, and soon a considerable number of cases were recorded. Bangalore and some other places in

Southern India suffered severely, and in August Bombay was again seriously affected. This renewed outbreak passed off in due course only to be succeeded by another, extending from February to July, 1899. In 1899 Calcutta was revisited, and other parts of India still continued to lose many lives by this scourge. The plague reached Madagascar in November, 1899, and this is the first authentic record of its appearance south of the equator. It was soon afterwards reported from Réunion, Mauritius, German and Portuguese East Africa, and West Africa. In July of that year some Spanish sailors arriving at Oporto died of the plague, and it also carried off others in this part of Portugal. The first instance of the plague in the New World was recorded from Brazil in November, 1899. The total number of cases of plague in India from 1896 to Feb., 1899, was about 225,000, and of these at least 200,000 died. Bombay city had 36,381 cases, and the total for the presidency was about 170,000. Mysore, Hyderabad State, several districts of Madras, some parts of the Punjab, and the Sind districts also suffered severely. The disease was still causing many deaths in North-Western India in 1902. Early in 1900 the first case of plague was recorded in Australia, but by September that country was practically free from the disease. Plague has since visited South Africa, and in 1800 there were a few cases at Glasgow.

PLAICE (*Pleuronectes platessa*), a Teleostean fish, included in the division Anacanthini, and belonging to the typical genus of the family Pleuronectidae or so-called 'Flat-fishes'. It is, however, to be clearly understood that these fishes are only and truly *flat-fishes* in the sense that the *sides* of the body are more compressed than in other fishes. The broad or flat surfaces of the body are not the back and belly, as is commonly supposed, but the *sides* of the fish. This may be demonstrated by noticing that the paired pectoral fins are placed one on each side, as in all other fishes. The eyes, which curiously enough are situated both on one side of the body, are thus placed from the bones of the head becoming twisted, so as to bring the eyes to the one side. One side of the body is darker than the other, the light or whiter side being that upon which the fish lies, and which is undermost when it swims. The head is thus asymmetrical. In the Plaice the eyes are situated on the right side of the body, the nearly allied Turbot possessing the eyes on the left side. The single, long, and continuous dorsal fin in the Plaice begins over the eyes, and nearly joins the tail fin, the anal fin on the opposite or ventral aspect of the body being similarly disposed. Both anal and dorsal fins are somewhat pointed towards the middle, this conformation imparting a rhomboid form to the outline of the body. The swimming-bladder is wanting in the Plaice. The Plaice attains an average length of 12 or 18 inches. The dark or upper side is coloured brown, spotted with red or orange; the body is comparatively smooth; the ventral fins are situated on the throat, and are thus jugular in position; the mouth is of small size, and provided with small teeth. These fishes are all 'ground fishes,' that is, feed and swim near the bottom of the sea. They are caught chiefly by means of trawl-nets. The Plaice is a favourite food-fish.

PLAIN, in geography, a more or less extended stretch of level or undulating land. Plains elevated more than about 1000 feet above the level of the sea are generally called table-lands or plateaus, but in some cases the term plain is used, from considerations of continuity, for level tracts situated at a greater elevation than 1000 feet. Plains may be classified according to their present character, or according to

their mode of origin, but, since the nature of plains is largely a result of the physical causes which produced them, these two classifications are not independent. Some are evidently of marine origin, such as the Atlantic coast plain of the United States, whilst others represent the beds of former lakes. Rivers form what are known as flood-plains, and the alluvial accumulations at their mouths may give rise to large delta-plains. Notable examples of such fluviatile plains are those of the Nile, the Ganges, and the Mississippi. Of less importance, though well represented in some parts of the world, are plains produced by enormous lava-flows and those always covered by a sheet of ice. In respect of fertility plains show all gradations from wholly barren salt-plains, such as the salinas of the Argentine Republic, and almost wholly barren deserts, such as are represented chiefly in Africa and Asia, to the highly productive alluvial plains of such great rivers as the Mississippi and the Ganges. Various special kinds of plains in different parts of the world are distinguished by special local names. Among these are the *landes*, or sandy plains in the south-west of France; the treeless *steppes* of southern Russia in Europe and Central Asia; the marshy *tundras* of northern Siberia; the arid *karroos* of Cape Colony; the *savannahs* and *prairies* of North America; the grassy *llanos* of the Orinoco valley; the forest-plains or *savannas* of the Amazon basin; and the treeless and partly barren *pampas* of the Argentine Republic.

PLAIN-SONG, the name given to the old ecclesiastical chant in its most simple state, and without harmonic appendages. The origin of plain-song in the church is lost in antiquity, and the mode of performing it is left to conjecture, which has by no means been happy in elucidating the subject. The earliest notation, which is in notes of equal length and without division, that is to say, without time or rhythm, leaves everything uncertain, except perhaps the fact that it could not have been so performed, and that the notation was then probably only an inadequate representation of what was orally taught, a mere assistance to the memory of the performer, and not an exact representation of the points of the performance. The plain-song may in some cases have been merely a kind of chant in unison, but the practice of the ancient church was probably not uniform. Ambrose of Milan and Gregory the Great introduced certain reforms into the church music of their day, regarding which see GREGORIAN MUSIC. Plain-song is written in many more modes than the two (major and minor) which are almost exclusively employed in modern music.

PLAINTIFF, in English law, the person who commences a suit against another at common law, called in Scotland a *pursuer*. One who commences a suit in equity is called a *complainant*, and in admiralty and ecclesiastical causes the person suing is described as a *libellant*. See DEFENDANT.

PLAN, a drawing showing the design of a building, series of buildings, or any projected work, chiefly used in reference to drawings showing the horizontal disposition of the various parts.

PLANARIANS, **PLANARIA**, a general name for flat-worms (Platyhelminthes) of the class Turbellaria, more especially applied to those with branched intestines. It is not now used in classification, except in the form *Planaria* as a generic name. Turbellarians have a flattened, leaf-shaped, or oval body with very soft tissues. The outer layer of the body covering, called the *ectoderm*, is covered with fine cilia, and rests on a stratified *basement-membrane*, beneath which is the *parenchyma*, containing muscular and connective fibres, nucleated cells, vacuoles, &c. The mouth is situated on the ventral surface of the body,

and opens into a usually protrusible, muscular pharynx, which communicates with the intestinal cavity, or *enteron*. The *Acœla*, however, have no enteron proper, and in their case the food is received into vacuoles. The intestine may be of simple form, as in the *Rhabdocœla*, or more or less branched, as in the other orders. Except in the lowest group (the *Acœla*) there is an excretory system of repeatedly-branching canals and terminal flame-cells. There is a double nerve-ganglion in the anterior part of the body, and from it proceed many branches, including two large ones towards the posterior end. Eyes are almost always present, and organs of hearing (*otocysts*) have been detected in some species. The eyes vary in number in different species; they usually occur over the nerve-ganglion or brain, but they may be situated on the margin of the body. Almost all Turbellarians are hermaphrodite, but the union of two individuals is required for reproduction. The development from the egg is either direct or through a palmately-lobed larva known as *Müller's larva*. Reproduction by simple division of the body occurs in some species. Turbellarians are classified into orders according to the nature of the intestine. The *Acœla* are marine forms without an intestinal cavity, and the *Rhabdocœla* have a rod-shaped intestine and mostly live in fresh water. The other orders have a more or less branched enteron, the chief being the *Tricladia*, with a three-branched digestive cavity, and the *Polyclada*, with a many-branched cavity. The *Tricladia* include marine, fresh-water, and land species, but the *Polyclada* are all marine. The *Planariæ* are a mainly fresh-water family of *Tricladia*, whose chief genera are *Planaria* (the type), with two eyes, and *Polycelis*, with many eyes on the margin. Both these genera are represented in Britain. The land planarians are most abundant in damp tropical forests. Of the seven families of *Polyclada*, three, forming the *Acotylea*, have no sucker on the under side of the body for adhering to rocks and other objects, whilst the rest, constituting the *Cotylea*, have such a sucker. The *Acotylea* further never have the mouth in front of the middle of the body, and the *Cotylea* never behind it. Tentacles occur in some species in both groups. *Leptoplanea tremelaris* is a suckerless form occurring on the British coasts. Turbellarians are usually comparatively small animals, and some of them are minute. They are carnivorous, but some contain green chlorophyll-cells which enable them to assimilate food as plants do. These cells have been regarded as symbiotic algae.

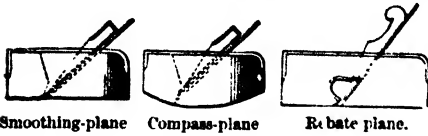
PLANE, a cutting instrument on the guide principle; practically a chisel guided by the stock or wooden handle in which it is set. Planes are of various kinds, as the *jack-plane* (about 17 inches



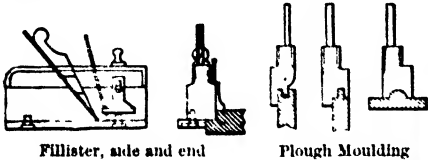
Jack-plane.

long), used for the rougher work; the *trying-plane*, used after the jack-plane; the *long-plane* (26 inches long), used when a piece is to be planed very straight; the *jointer*, still longer, used for obtaining very straight edges; the *smoothing-plane* (7½ inches long) and *block-plane* (12 inches long), chiefly used for cleaning off finished work; the *compass-plane*, similar to the smoothing-plane, but with the under surface convex, its use being to form a concave cylindrical surface. The foregoing are technically called *bench-planes*. There is also a species of planes called *rebate-planes*, the first of which is simply called the *rebate-plane*, being chiefly used for making rebates.

Of the sinking rebating planes there are two sorts, the *moving-filister* and the *sash-filister*, the first for



sinking the edge of the stuff next the workman, and the second for sinking the opposite edge. The *plough* is a plane for sinking a channel or groove in a sur-



face, not close to the edge of it. *Moulding planes* are for forming mouldings, and must vary according to the design. See PLANING-MACHINE.

PLANE, in geometry, a surface characterized by the property that the straight line joining any two points in it lies wholly in the surface, a level surface. Two such surfaces cannot have three points, not in a straight line, in common without coinciding throughout, and any two planes intersect in a straight line. Parallel planes are those whose line of intersection is at an infinite distance, or such as can have a common normal or perpendicular. The angle between two non-parallel planes is that formed by two intersecting straight lines, one in either plane, perpendicular to the line of intersection. There will always be two such angles, each being the supplement of the other, but in ordinary cases the acute one will be most naturally regarded as the angle formed by the planes. One plane is perpendicular to another when the angles thus formed are right angles, or, to put the same thing in a simpler way, when it contains a straight line perpendicular to that other. Three planes will always have one point in common, but this point may be infinitely removed; and they form a solid angle, which is measured in a special way. Three mutually perpendicular planes, known as the co-ordinate planes, are used in analytical geometry of three dimensions for determining the position of points in space. The point of intersection of the three planes is called the origin (O), and the mutually perpendicular lines of intersection (OX, OY, OZ) are known as axes of co-ordinates. The position of any given point is determined by the lengths intercepted between it and the planes, of straight lines drawn parallel to these axes. These lengths are denoted generally by the signs x , y , z , the first referring to the distance parallel to the axis of x (OX), and so on. According to this system $Ax + By + Cz = 0$ is the general equation of any plane. The co-ordinate planes are sometimes taken inclined at oblique angles to one another. In the perpendicular projection used in descriptive geometry two reference co-ordinate planes, called the vertical (VP) and the horizontal (HP), are used. The projection of any point, line, surface, or solid on the former is called its elevation, and the projection on the latter its plan. The line of intersection of the reference planes is usually called the ground-line, and is denoted by XY. In this system a plane is represented by the projections of its traces, that is, the straight lines in which it intersects the co-ordinate planes. The plan of the vertical trace and the elevation of the horizontal trace both co-

incide with the ground-line, so that the actual representation of a plane consists of two straight lines intersecting each other in the ground-line. It should be noted that in this system the two projections, elevation and plan, are brought into one plane by causing the vertical plane to revolve backwards round XY, and that this position is the one actually drawn on paper. The eleventh book of Euclid's Elements treats of planes. See INCLINED PLANE.

PLANE, PLANE-TREE (*Platanus*), a genus of trees belonging to the natural order Platanaceæ, which includes no other genus. The species have alternate, petiolate, palmately-lobed leaves, and monocious flowers in pendent, long-stalked, globular heads. They are found in the temperate and sub-tropical regions of the northern hemisphere. *P. occidentalis* is the American or Western Plane-tree or Button-wood, a large tree which abounds most and attains the largest size along the interior waters of Pennsylvania and Virginia, and especially along the banks of the Ohio. Here stems are sometimes found from 10 to 14 feet in diameter, often beginning only to give out their vast branches at the height of 60 or 70 feet, and near the summits of the surrounding trees. In the Western States this tree is usually known by the name of *sycamore*, and in some districts is called *cotton-tree*. The trunk and branches are covered with a smooth, pale-green bark, the outer layer of which scales off in portions, the leaves are large and three or five-lobed, and the flowers are united in little globular, pendent balls. The wood in seasoning takes a dull red colour, is finely grained, and susceptible of a good polish, but speedily decays on exposure to the weather. The Oriental Plane (*P. orientalis*), so celebrated by the ancients for the majesty of its appearance, resembles the preceding, and bears the same relation to the forests of Western Asia. Both are beautiful trees and have long been cultivated in Britain. The oriental is the hardier, and is especially suited for planting in towns, fine specimens being seen in London. Both grow to a large size in Britain, though sometimes killed by severe frosts. The wood of the oriental plane is used for cabinet and other work. *P. racemosa* is a species found in California. The Common Sycamore, or Greater Maple (*Acer Pseudo-platanus*), is called in Scotland the plane tree. See MAPLE.

PLANET, a name given originally to those celestial objects which change their places in the heavens, but which is now given to any body, like the earth, which revolves in an elliptic, nearly circular, orbit round a sun, and which shines by reflected light. The known *major* planets are, in the order of their proximity to the sun, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Mercury, Venus, Mars, Jupiter, and Saturn were known to the ancients. The *minor* planets form a zone of asteroids between the orbits of Mars and Jupiter. Kepler, Titius, and Bode, observing indications of relations existing among the planetary distances, constructed the well known 'Bode's law.' This empirical law is: Adding the constant number 4 to every term of the series 0, 3, 6, 12, 24, &c., gives the relative distances of the planets from the sun. The numbers so obtained correspond closely with the true relative distances, except in the case of Neptune. The relative distances of Jupiter's satellites from the planet are expressed by adding 7 to each term of the series 4, 10, 25, 62.5, the constant multiplier being 2½. In Saturn's system the constant number to be added is 4, and the series 1, 2, 4, 8, &c. On the discovery of Uranus, whose mean distance coincides with that calculated from Bode's law, Bode asserted that astronomers might with advantage search for a planet between the orbits of Mars and Jupiter, a

part of the heavens in which no planetary body had as yet been observed. Piazzi soon afterwards (1801) discovered Ceres, the first of the minor planets, and since then scarcely a year has passed without new names being added to the list of these bodies. The law fails in the case of Neptune, yet perhaps neither Adams nor Leverrier would have attempted by calculation the discovery of this planet had they not been assured by the law that the planet lay within certain limits of distance.

The intra-asteroidal planets are all small compared with the extra-asteroidal, but in these two families there is no trace of a law as to relative size. The extra-asteroidal planets seem to rotate axially in

periods of about ten hours; the axial periods of the intra-asteroidal are about twenty-four hours. The directions of axial rotation seem to be in every case the same, being the common direction of rotation about the sun (the case of Neptune being still regarded as doubtful, however). The inclinations of axes differ considerably. The orbits are all nearly in the plane of the ecliptic, but with regard to the medial orbital plane the orbits are more nearly alike in their inclinations.

The elements of the planets and their satellites are given in the following tables. The plate at the article ASTRONOMY shows the most important relations existing among the elements of the planets.

Planet.	Distance from the Sun.			Distance from the Earth.		Time of Revolution round the Sun.	Synodic Revolution.
	Mean	Greatest.	Least	Greatest	Least		
	Miles	Miles	Miles	Miles	Miles	Mean Solar Days	Mean Solar Days
Mercury	36,000,000	43,400,000	28,800,000	134,800,000	50,900,000	87.9693	115.857
Venus	67,200,000	67,700,000	66,700,000	161,200,000	24,500,000	224.7008	583.920
The Earth.....	92,900,000	94,500,000	91,300,000			365.2524	
Mars	141,500,000	154,700,000	123,800,000	248,600,000	34,500,000	686.9796	779.936
Jupiter	483,000,000	506,600,000	460,000,000	509,500,000	367,200,000	4332.5882	398.884
Saturn	886,100,000	935,800,000	830,400,000	1,027,200,000	745,100,000	10759.2364	378.092
Uranus	1,782,000,000	1,864,500,000	1,699,600,000	1,956,900,000	1,607,800,000	30688.8904	369.856
Neptune	2,792,000,000	2,817,000,000	2,767,000,000	2,909,100,000	2,675,000,000	60181.1182	367.486

Planet	Time of Rotation on Axis.			Inclination of the Planet's Equator to its Orbit.	Equatorial Diameter	Volume, Earth's = 1	Mass, Earth's = 1	Density, Earth's = 1	Force of Gravity, Earth's = 1	Bodies fall in 1 second	Apparent Diameter as seen from the Earth.	
	h.	m.	s.	deg.	min.	miles					Greatest.	Least
Mercury.....	?	?	?	?	?	3,000	0.052	0.061	1.173	0.439	7.06	12.9
Venus	?	?	?	?	?	7,700	0.975	0.787	0.807	0.802	12.90	6.2
The Earth.....	23	56	4	23	27	7,927	1.000	1.000	1.000	1.000	16.08	
Mars	24	37	23	24	50	4,230	0.147	0.106	0.711	0.876	6.05	24.5
Jupiter	9	55	37	8	5	88,200	1279.412	809.816	0.242	2.261	36.36	50.0
Saturn	10	14	24	26	49	75,000	718.888	91.919	0.128	0.892	14.34	20.0
Uranus	?	?	?	?	?	32,000	69.287	18.513	0.195	0.754	12.12	4.1
Neptune.....	?	?	?	?	?	35,000	54.955	16.469	0.800	1.142	18.36	2.9

SATELLITES.

Primary.	No	Name of Satellite	Distance from Primary	Sidereal Revolution			Inclination of Orbit to Plane of Ecliptic			Diameter	Apparent Star Magnitude	Name of Discoverer.
			miles	d	h	m	deg	min	sec	miles		
The Earth..	1	The Moon.	238,840	27	7	43.2	5	8	40	2,163
Mars.....	1	Phobos	5,830	0	7	39.2	26	17	2	71	12	Asaph Hall, 1877.
	2	Deimos	14,640	1	6	17.9	25	47	2	51	12	
Jupiter....	1	Io.	261,000	1	18	27.6	2	8	3	2,500	7	Galileo, 1610.
	2	Europa	415,000	8	13	13.7	1	38	57	2,100	7	
	3	Ganymede.	664,000	7	3	42.6	1	59	53	3,650	6	
	4	Callisto.	1,167,000	16	16	32.2	1	57	0	2,960	7	
	5	....	112,500	0	11	57.4	2	20	23	?	?
Saturn	1	Mimas.	117,000	0	22	37.1	23	10	10	600?	17	Sir W. Herschel, 1789.
	2	Enceladus	167,000	1	8	53.1	23	10	10	800?	15	
	3	Tethys.	186,000	1	21	18.4	23	10	10	1,100?	18	
	4	Dione.	238,000	2	17	41.2	23	10	10	1,200?	12	
	5	Rhea.	332,000	4	12	25.2	23	10	10	1,500?	10	
	6	Titan.	771,000	15	22	41.4	27	38	49	8,500?	8	
	7	Hyperion.	984,000	21	6	39.5	27	4	48	500?	17	
Uranus.....	8	Japetus.	2,325,000	79	7	54.3	18	31	30	2,000?	9	Barnard, 1892.
	1	Ariel.	120,000	2	12	29.4	97	51		500?	?	
	2	Umbriel.	167,000	4	3	27.6	82	9		400?	?	
	3	Titania.	273,000	8	16	56.5	....			1,000?	?
Neptune ...	4	Oberon.	365,000	13	11	7.1			800?	?	Sir W. Herschel, 1787
	1	....	225,000	5	21	2.7	145	12		2,000?	14

As the axes of rotation of the planets are inclined to their orbits, and as they have all equatorial protuberances, their axial motions are precessional and nutational rotations. (See PRECESSION.) One of the most interesting problems in astronomy is that which was first solved by Lagrange when he enunciated

the laws relative to the stability of the solar system. Laplace showed in 1784 that in any system of bodies rotating in the same direction round a central attracting orb, the eccentricities and inclinations, if small at any one time, will always remain inconsiderable.

PLANE-TABLE, an instrument used in topo-

graphical surveying, especially for making maps after a triangulation has been completed. It consists essentially of a drawing-board mounted on a tripod, and capable of being levelled and turned in azimuth through any angle. This board is used along with an alidade, or ruler (usually of brass) bearing a telescope whose line of collimation is always in the same plane as the edge of the ruler. The telescope is accompanied by a vertical graduated arc, and the brass ruler generally carries a delicate magnetic needle. The plane-table has been in use for a very long time, and, though not capable of minute accuracy, it is still widely employed in topographical surveys.

PLANETARIUM. See ORRERY.

PLANIMETER, AMSLER'S, an instrument by means of which the area of a plane figure may be measured. It is employed by surveyors in finding areas on maps, &c. It consists of a rod *OB*, which may be attached to the paper on a drawing-board by means of a pin at *O*, which is the centre of a circle described by *B*. *BAP* is a second straight rod jointed to the first at *B*; at the end *P* there is a pointer which is to be carried round the boundary of the area to be measured. A wheel at *A* on this rod, nearer *B* than *C*, has a thin edge, which enables it to roll without sliding on the paper in a direction at right angles to the rod *BP*. The rim of this wheel is graduated, and an index fixed to the rod enables the amount of motion of *BP* in a direction at right angles to its length to be measured. Now the area swept out by the rod *BP* during any motion in a plane is equal to the length of the rod multiplied by the amount of its normal motion; hence this area is known from the readings of the wheel if we adopt the well-known algebraic convention as to positive and negative areas. When the centre *C* is external to the area to be measured, a rough sketch will show that the reading of the wheel represents this area. When *C* is inside, to the reading of the wheel a constant must be added expressing the area of the circle described by *B*. In every case the reading of the wheel must be multiplied by a particular constant depending on the scale of the drawing.

PLANING-MACHINE, a tool or instrument wrought by steam-power, for saving manual labour in producing a perfectly plane surface upon wood or metal. This is usually accomplished in metal-planing machines by such an arrangement of mechanism as will cause the object which is to be operated upon to traverse backwards and forwards upon a perfectly smooth and level bed, while the cutting tool is fixed to a cross slide above it, and slightly penetrates the surface as it is carried along. The tool is acted upon by screws, so as to enable the attendant to adjust the depth of the cut, and to move it with unerring precision over every part of the surface which it is required to plane. In 1791 Samuel Bentham, brother of the celebrated Jeremy, invented a planing-machine for wood on the reciprocating principle now usual in those for metal. Bramah in 1802 patented the first transverse planing-machine for wood, in which the rough work was done by a wheel provided with gouges, the finishing being effected by planerons. The cylinder planing-machine, now almost always employed for wood, came somewhat later. In it the planing is effected by means of cutters fixed on a rotating drum with horizontal axis. The cylinder principle when applied to metal work gives rise to the milling-machine.

PLANT. See PLANTS.

PLANTAGENET, a family the various branches of which occupied the throne of England from the reign of Henry II. (1154) until the accession (1485) of Henry VII., the representative in the female

line of the Lancastrian branch of it, who, by his marriage (1486) with Elizabeth of York, daughter of Edward IV., representative of the York branch, united its various branches in the house of Tudor, of which he was the direct descendant. On the death of Henry I. the crown was claimed by his daughter, Maud or Matilda, first married to Henry V., Emperor of Germany, and afterwards to Geoffrey V., Count of Anjou, surnamed Plantagenet, on behalf of her son by the latter, Henry Plantagenet. Stephen obtained it during his lifetime, and was succeeded on his death by Henry, who became the first of the Plantagenet kings. The name is said to have been derived from the circumstance of the Count of Anjou wearing a branch of broom (*plante de genêt*) in his cap. The direct line became extinct in Richard II. (1400), before whose death the crown was usurped by Henry IV., son of John of Gaunt, duke of Lancaster, fourth son of Edward III., in prejudice of Edmund and Anne Mortimer, the descendants of Lionel, duke of Clarence, third son of the same Edward. He was succeeded by his descendants Henry V. and Henry VI., and during the reign of the latter Edmund Mortimer having died without heirs, Richard, duke of York, son of Anne Mortimer, who had married the heir of Edmund, duke of York, fifth son of Edward III., claimed the crown. This occasioned the wars of the Roses, which terminated in the accession of Henry VII. as above mentioned. See ENGLAND.

PLANTAIN (*Plantago major*), a common weed, order Plantaginaceæ, with leaves radical, oval, and petiolate, and long cylindrical spikes of greenish inconspicuous flowers. It is found in meadows, fields, and on the borders of roads. Its leaves, root, and seed are used in popular medicine (the leaves being applied to wounds and ulcers), and its seeds for the food of cage-birds. Rib-grass (*P. lanceolata*) belongs to the same genus. For the tropical plantain, a species of banana, see PLANTAIN-TREE.

PLANTAIN-EATERS, a group of Scansorial or climbing birds usually placed near the woodpeckers and the parrots, and included in the family Musophagidæ. These birds occur exclusively in Africa. The bill is of moderate size, of compressed form, broad at its base, the tip being notched and the ridge curved. The toes are elongated, and the outer toe can be turned either forwards or backwards. The tarsi are covered by large scales. All the species have ten rectrices or tail-feathers. In one section of the family the primary wing-feathers are of a brilliant red colour, and species of this group are often called *louris* in Africa. The genus *Musophaga* includes the most typical forms. These birds chiefly feed upon the fruit of the banana and plantain. In this genus the base of the bill appears as a broad plate covering the forehead. The plumage exhibits brilliant coloration. The *Musophaga* inhabit tropical Africa. The members of the genus *Corythaix*, called *touracos*, possess a bill of ordinary size and conformation, and an erectile crest, borne on the head. The general colour is green, the quills of the wings and tail being coloured red. They feed on insects, in addition to fruits, and are said to be exceedingly familiar and tame in habits even in a wild state. They attain a size averaging that of the common pigeon or crow.

PLANTAIN-TREE, the type of the natural order Musacæ (which see). *Musa paradisiaca*, the plantain, and *M. sapientium*, the banana, are cultivated in mostly all tropical countries. They are magnificent palm-like trees, the stems of which grow to a height of 20 or more feet, bearing on their summits eight or ten large leaves, each 5 or 6 feet long, and 18 inches in breadth. These leaves, the most remarkable for

size in any herbaceous plant, spring from long stout petioles, the bases of which form the stem. The dried leaves supply thatch for the Indian cottages, and serve the natives for many other economic purposes. The fruit of both species is extensively used as food by the natives of the tropics. The flower-spike springs from the centre of the tuft of leaves, and consists of an immense number of florets. As the florets of the base become mature the fruit swells out, and the other florets are pushed forward, until the stalk on which they are borne reaches the length of 3 or more feet, and produces sometimes fruits to the number of 150 to 180, weighing together from 60 to 70 lbs. Each fruit is about 6 inches long, straight, and about an inch in diameter, rather shorter and thicker in the banana than in the plantain. When ripe the fruit is of a pale-yellow colour, and has a luscious, sweet pulp. It is one of the most useful fruits in the vegetable creation, and, as some of the plants are in bearing most of the year, forms the main sustenance of millions of the inhabitants of tropical climates. When used as bread it is roasted or boiled when just full grown; and when ripe, it is made into tarts, sliced and fried with butter, or dried and preserved as a sweetmeat. Three dozen plantains are esteemed sufficient to serve one man for a week, instead of bread. See BANANA.

PLANTATION. (1st.) A term anciently used to designate a colony. Plantations, according to Blackstone, are colonies where the lands are claimed by the right of occupancy only, by finding them desert and uncultivated, and peopling them from the mother country; or where, when already cultivated, they have been either gained by conquest or ceded by treaties.

(2nd.) A wood or piece of ground covered with trees. In England, by 24 and 25 Vict. cap. xcvi. s. 32, if any person steal, cut, break, root up, or otherwise destroy or damage, with intent to steal, any tree, sapling, shrub, or underwood growing in a park, pleasure-ground, garden, orchard, or avenue, or in any ground belonging to any dwelling-house, he is liable, if the injury amounts to £1, to penal servitude for three, or imprisonment for two years; for damaging similar property growing in any other situation to the extent of £5, with intent to steal, he is liable to the same penalty. For stealing any of these articles to the value of 1s. wheresoever growing he is liable to a fine of £5, besides the value of the article, for the first offence; for the second, he is liable to hard labour in the house of correction for twelve months, and if the conviction be before two magistrates to whipping; for a third offence, to penal servitude, or imprisonment as above. The same penalties are inflicted by cap. xcvi. s. 19 for maliciously injuring (without intent to steal).

Various acts of the Scottish Parliaments were passed to encourage planting and inclosing, and to punish those who should injure or destroy trees or plantations. At common law injuries done to trees or plantations are punishable as malicious mischief, and by statute two justices of the peace may impose penalties for such injuries. The penalties are, for setting fire to trees, breaking, cutting, or peeling them, £10 Scots for each tree under ten years of age, and £20 for each tree over that age.

PLANTIGRADA, PLANTIGRADES, the term applied in zoological science to such Mammals as walk with the whole sole of the foot applied to the ground. The name Plantigrada is, however, more specifically used to indicate a section of the order Carnivora (which see), represented typically by the Ursidae or Bear family, and also by other less familiar forms, such as the Racoons, Coatis, and the Badgers. The sole of the foot in these forms is usually destitute of a hairy covering. The conformation of the feet

enables these animals to assume the semi-erect position with ease. The feet are five-toed. The intestine wants a cecum. Some carnivorous forms, exemplified by the Mustelidae or Weasels, and by the Viverridae or Civets, are collectively termed *semi-Plantigrada*, from the fact that they apply part of the sole to the ground in walking, and thus link together the Plantigrades and those Carnivores (for example, Cats, Lions, Tigers, Dogs, &c.) which walk on the tips of the toes, and which are hence termed Digitigrada. The term is not now used in classification, but *plantigrade* is a convenient descriptive term.

PLANTIN, CHRISTOPHE, a famous sixteenth-century printer, was born about 1514 at St. Avertin, near Tours. In 1549 he established himself at Antwerp as a bookbinder, and in 1555 he began to print books in the classical and other languages. The works that issued from his press were characterised by scrupulous accuracy and beautiful workmanship. His son-in-law, Jan Moerentorf (Johannes Moretus), succeeded him in his Antwerp business, and two other presses which he founded at Leyden and Paris were afterwards carried on by his other two sons-in-law, Franz Rapheleng and Egide Le Bé (Egydius Beys). The finest production of Plantin's press was a Biblia Polyglotta, published in eight volumes in 1569-73. All the works printed by him bear the motto, Labore et Constantia. He died at Antwerp on July 1, 1589. In 1877 the city of Antwerp bought the offices of the business with all their collections from the successors of Moretus, and these now constitute the unique Musée Plantin-Moretus, which contains, in addition to valuable collections relating to the history of printing, a gallery of important pictures by Rubens, Van Dyck, and others. See the works by Max Rooses entitled *Christophe Plantin* (2nd edn., 1892), *Correspondance de Christophe Plantin* (two vols., 1884-86), *Musée Plantin-Moretus à Anvers: Notice Historique* (1894), and *Catalogue du Musée Plantin-Moretus* (3rd edn., 1887); also Debacker and Ruelens' *Annales Plantiniennes* (1865).

PLANT-LICE (Aphides), an interesting group of Hemimetabolic insects, belonging to the order Hemiptera, and to the Homopterous section of that order. These insects possess short oval bodies, six legs, and a pair of antennæ. They exhibit an alternation of winged and wingless individuals, the reproduction of these insects forming one of the most peculiar phases which can well be conceived of in the generation of animal forms. Their reproductive history is described at length in the article on PARthenogenesis (which see). When wings are developed the front pair are membranous throughout their entire extent. The rostrum or 'beak' springs from the breast or posterior portion of the head, the mouth being turned backwards. The tarsi are composed of two joints, and are provided with two claws. These insects are specially notable on account of their destructive effects upon vegetation of all kinds. They live upon plants, and imbibe by means of their suctorial mouths the juices of the plant tissues, causing the decay or death of the vegetables. Many species of Aphides are known. The *Aphis Roseæ* of the rose bushes is a very familiar species; *A. Rapa*, of a green colour, infests turnips; *A. Fabæ*, coloured black, lives upon the bean; *A. vastator* attacks the potato and other plants. The leaves of the infected plants wither, curl up, and become distorted when attacked by these insects. The Woolly Aphis (*A. lanigera*), so named from a kind of woolly substance covering the body, attacks apple-trees. This insect first appeared in England in 1787, and from the supposition that it was imported from America the popular name of 'American Blight' has been applied

to it. The *Hop Aphis* (*A. humuli*) is a species upon the absence or presence of which the prosperity or failure of the hop crop may in some seasons chiefly depend. Vast differences in the returns from the hop duty, representing the increase or deficiency of large sums of money, may in this way be said to depend upon these minute pests. The Aphides possess glandular structures opening at the extremity of the abdomen in little tubular orifices, which secrete a sweet, viscid fluid, of which ants are very fond. And the ants regularly 'milk' the Aphides by stroking their abdomens for the sake of this sweet liquid, which exudes from the glands in drops. The larvae of the Coccinellæ or 'Lady-bird' beetles are very destructive to the Aphides; these immature beetles and also the adult lady-birds devouring the plant-lice in great numbers, and thus aiding in limiting the rapid increase of the pests.

The remarkable fecundity of the plant-lice forms one of the chief notable points in their economy. It has been calculated that the progeny of a single aphid traced to the fifth generation only, may number 5,904,900,000, and in one year the progeny of one female may number 100,000,000,000,000,000! The eggs produced by male and female insects are deposited on the axils of leaves during the autumn. These are hatched during the succeeding spring, and females alone are produced. These females, or 'fruitful virgins' as they are called, continue to produce similar and female beings viviparously, and without the presence of any male, till the ensuing autumn. See PARTHENOGENESIS.

PLANTS. See BOTANY. As to plants in law it is enacted by 24 and 25 Vict. cap. xxxvi. if any person steal, destroy, or damage with intent to steal, any plant, root, fruit, or vegetable production growing in any garden, orchard, nursery ground, hothouse, greenhouse, or conservatory, every such offender shall, at the discretion of the justice, either be committed to be imprisoned only, or to be imprisoned or kept to hard labour for any term not exceeding six months, or else pay, over and above the value of the article stolen, or the amount of the injury done, any sum not exceeding £20. On a second conviction the offender is liable to penal servitude for three years, or imprisonment not exceeding two years. If any person steal, destroy, or damage with intent to steal, any cultivated root or plant used for food of man or beast, or for medicine, distilling, or dyeing, growing in any land, whether inclosed or not inclosed, not a garden, orchard, &c., he may be committed for one month, with or without hard labour, and on a second conviction for six months, with or without hard labour. See also PLANTATION.

PLASENCIA (ancient *Ambraca*), a town of Spain, in the province of Cáceres, on the Jerte, 120 miles w.s.w. of Madrid. Its walls, flanked by numerous towers, are crumbling to pieces, but the streets are generally well formed and the houses well built. The principal buildings are an unfinished Gothic cathedral, begun in 1498; the episcopal and several private palaces, the seminary, a large aqueduct, bridges, &c. It was sacked and almost destroyed by Sout in 1809. Its chief industrial establishments are tanneries, and silk, oil, and flour mills. Pop. 6000.

PLASSEY, a village in Hindustan, on the Hugli, in the Nadiya district of Bengal, 80 miles north of Calcutta. Here on June 23, 1757, Colonel, afterwards Lord Clive, with a mere handful of men, consisting of about 900 Europeans and 2100 sepoy, defeated Suraja Dowla, with an army consisting of 50,000 foot and 18,000 horse, and laid the foundation of the British Empire in India.

PLASTERING is the art of covering the surface

of masonry or wood-work with a plastic material in order to give it a smooth and uniform surface, and generally in interiors to fit it for painting or decoration. Technically the term plastering is used only when the plaster is spread over a screen of laths fixed to the wall, rendering being used to describe the operation of plastering a bare wall. The chief preparations used by plasterers are known as *coarse stuff*, *fine stuff*, *plasterers' putty*, and *gauged stuff*. The first of these is composed of sand and lime, mixed with long ox hair; the second is slaked lime, usually without hair; the third is not unlike the second; and gauged stuff is a mixture of plasterers' putty and plaster of Paris. Three kinds of plastering are distinguished, namely, one-coat (lath and lay), two-coat (lath, lay, and set), and three-coat (lath, lay, float, and set). In one-coat work a layer of coarse stuff is spread over the laths, and pressed well into the spaces so as to form a key to hold the coat in place. When a second coat is to be applied, the first is not smoothed, but roughened with a birch-broom so as to retain the second one in place. The second coat consists of fine stuff, putty, or gauged stuff. In plastering the interior of houses a first coat is laid on of coarse stuff, the process being known as *pricking-up*. The face of the first coat, which should be of considerable thickness, is trowelled, or indented diagonally with the point of a lath, to form a key for the finishing coats. The second coat is applied to this when it is thoroughly dried. It consists of fine stuff, and is rubbed in with a flat board so as thoroughly to fill the indentations and cover the unequal surface of the first coat with a smooth and even one. In plastering walls great care must be taken to have the surface perfectly vertical. This second coat is called the *float* coat, because wooden boards, known as *floats*, are used in rendering the surface plane. Before drying, this coat is scraped with a birch-broom to form a key for the next. The setting coat is applied to the second after it has become perfectly dry. If the wall is to be papered, this coat is of fine stuff, but other mixtures are used for other purposes. Walls cannot be rendered unless they are rough.

PLASTER OF PARIS. See PARIS (PLASTER OF).

PLASTERS are applications of local remedies to any part of the surface of the body by means of a supporting texture of leather, silk, or other cloth, or merely of paper, and frequently with the aid of some adhesive substance. Plasters may be intended merely to give protection, support, or warmth, as in the case of wounds, bruises, or local weakness, or they may be actively medicinal. A largely used class of plasters called blisters is described under that head. The British Pharmacopœia gives twelve prescriptions for plasters, in most of which the adhesive property is due to the combination of oxide of lead with fatty acids. The materials most frequently used in plasters are belladonna, cantharides, galbanum, iunglaun, lead, mercury, opium, pitch, resin, iron, and soap.

PLATA, LA, UNITED PROVINCES OF. See ARGENTINE REPUBLIC.

PLATA, RIO DE LA. From the Andes and the mountains of Brazil rivers of great magnitude descend, and, meeting together, pour their united waters into the ocean through a common outlet. This outlet is the river La Plata, which is in reality not a river so much as an estuary receiving great rivers. At its mouth, between Cape St. Antonio, and Cape St. Mary, it has a width of 170 miles. About 50 miles higher up, near Monte Video, where it is reduced to a width of 62 miles, its waters are already quite fresh. At Buenos Ayres, 150 miles farther up, the land, being low, is not visible from the middle of the stream. The junction of the

tributary rivers which forms the commencement of the La Plata takes place 30 to 40 miles above Buenos Ayres. The current of this great river is perceptible in the Atlantic at a distance of 100 miles, or even 200 miles; yet the depth of the stream is by no means proportional to its breadth. At Monte Video the mean depth is under 15 feet, and only by constant dredging are large vessels enabled to approach the quays of Buenos Ayres. The great rivers which unite to form the La Plata are the Paraná and the Uruguay, both of which are separately treated. Monte Video and Buenos Ayres are almost the only ports of the La Plata visited by foreign ships.

PLATEA, a town in Boeotia, celebrated for the battle in which the Persians, under Mardonius, were defeated by the Greeks, B.C. 479. After Xerxes had been defeated at Salamis he returned with the greater part of his forces, but left 300,000 men under Mardonius in Thessaly to influence the negotiations of that commander with the Greeks. On the failure of his attempts to negotiate, Mardonius advanced towards Attica, and laid waste everything with fire and sword. One hundred thousand Greeks under Pausanias and Aristides, having solemnly sworn to prefer death to subjugation, advanced against the Persians, and the two armies met near the small town of Platea, September 25. The loss of the Greeks was inconceivable. Mardonius fell, and hardly one-tenth part of his army escaped by flight; but few ever returned to their country. On the same day the remnant of the Persian fleet, which had escaped from Salamis, was destroyed off Mycale by the Greeks under the Athenian Xanthippus and the Spartan Leotychides. From that time Greece was freed from invasions from Persia. The Plateans distinguished themselves both at Marathon and Platea. In the Peloponnesian war Platea sided with Athens, and was besieged in B.C. 429 by a Theban and Lacedæmonian force. The siege lasted for two years, when at last the garrison were compelled from hunger to surrender. They were put to the sword and their city destroyed. It was rebuilt in accordance with the terms of the Peace of Antalcidas (387), but the inhabitants were soon after driven out by the Thebans, and the town was not finally reoccupied till after the battle of Chæronea.

PLATE. Gold and silver plate, after a preliminary assay, is stamped with certain prescribed marks, guaranteeing its legal fineness, by assay offices or goldsmiths' halls established by authority at London, Birmingham, Sheffield, Chester, Edinburgh, Glasgow, and Dublin. The gold or silver article in its roughly finished state, having been stamped by the maker with a registered mark (the initial letters of his name or those of the firm), is sent to an assay office, where an assay-sample is scraped or cut from it. If this sample on being tested proves that the material of which the article is made is of the legal standard declared by the maker, the article is marked; otherwise it is broken up and returned to the maker. Fees are paid for the assay and marking, and formerly a government duty (abolished 1890) was payable on plate and certain other articles. The more recently established offices, Birmingham and Sheffield, are required by Act of Parliament, out of the assay-sample taken from every article marked, to reserve a portion to put into a receptacle, called the diet-box, which is sent up annually to the Royal Mint in London. Here individual samples and the samples in bulk are retested before the master of the mint; if all are found satisfactory the assay master receives a certificate, otherwise he is fined and discharged.

The fineness of gold is expressed in carats. Pure gold is said to be 24 carats fine. The name carat in

this relation signifies the twenty-fourth part by weight. Thus, a piece of gold 18 carats fine will contain $\frac{18}{24}$ ths of pure gold and $\frac{6}{24}$ ths of alloy. Until 1798 gold articles of a lower standard than 22 carats could not be hall-marked, but in that year the standard of 18 carats was legalized, and more recently, in 1854, to meet foreign competition, standards of 15, 12, and 9 carats were introduced. In Ireland in 1784 an additional standard of 20 carats was made legal.

The fineness of silver is expressed by the number of ounces and pennyweights of pure silver contained in the pound troy. Sterling silver is composed of 11 ozs. 2 dwts. silver and 18 dwts. alloy. This is the standard of the British coinage and of silver plate in general. There is a higher standard for silver plate, now little used, which contains 11 ozs. 10 dwts. of silver per lb. The degree of fineness of both gold and silver is frequently reported in 1000th parts; e.g. in this system gold of 15 carats is represented by the decimal '625.

The marks stamped at the offices in England on silver plate of the fineness of coin, are a lion passant, indicating the standard, an alphabetical letter, changed yearly, indicating the date when marked, and a distinctive mark peculiar to each office. This latter mark is for London a leopard's head, for Birmingham an anchor, for Sheffield (where silver articles only are stamped) a crown, and for Chester a sword between three wheat sheaves. On silver of the higher standard a figure of Britannia is substituted for the lion, the other marks remaining the same, except that at London a lion's head erased replaces the leopard's head. Gold plate is stamped with the date, letter, and distinctive mark as above, and with the following standard marks: on articles of 22 or 18 carats, a crown and the figures 18 or 22; on 15, 12, or 9 carats, the figures 15 and '625, 12 and '5, 9 and '375 respectively without the crown. Similar marks are used in Scotland, but the standard mark at Edinburgh for silver is a thistle, and at Glasgow a lion rampant, and these marks are used also on gold articles, in place of the crown, in conjunction with the figures indicating the standard; the distinctive marks are respectively a castle with three towers, and a tree with a bird, fish, and bell. In Dublin the standard mark for silver plate and gold of 22 carats fine is a harp crowned; for 20 carats a plume of three feathers; for 18 carats an unicorn's head. Articles of the Britannia-silver standard are not marked at this office, of which the distinctive mark is a figure of Hibernia. The mark of the sovereign's head, indicating that the plate duty had been paid, was in use between 1784 and 1890, and was common to all assay offices.

The practice of hall-marking dates back to the year 1300, when by statute it was ordained that vessels of silver shall be assayed and marked before leaving the hands of the maker, and this obligation extended to articles of gold. The Assay Laws have since been amended from time to time, and the legislature has always imposed severe penalties in their defence to ensure, in the interests of the public, the integrity of the hall-mark. The enforcing of the law and its practical working is entrusted to the assay masters and wardens of the established offices. Gold and silver plate, with certain exceptions, is compulsorily submitted to their control, but it is optional on the part of the maker of the exempted articles and of jewellery to subject them to control or not. The credit of the hall-mark with the public is such, however, that a very small proportion of gold and silver articles is sold unprovided with the hall-mark, and the absence of the hall-mark on many of these articles is due to the fact

that they are of too fragile a nature to bear without injury the prescribed marks.

PLATE-GLASS. See GLASS.

PLATE-POWDER. Red oxide of iron, called jewellers' rouge, is the best powder for cleaning gold; for silver, prepared chalk of the best quality should be used. The powder may be applied with a plate-brush, and chamois-leather or soft woollen rags used in cleaning up the plate.

PLATING. For the process of plating with the precious metals now in most general use see ELECTRO-PLATING. The method which formerly prevailed, and which is still a good deal used, though declining under the influence of electro-plating, is called Sheffield-plating. The metal commonly used for plating with silver was at one time copper alone, or alloyed with brass; but German silver or some white metal alloy is now generally used, as it does not discolour the plate where the coating of silver becomes thin. Gold is generally plated on silver. In Sheffield-plating the superior metal is laid on an ingot of the inferior, one or both sides of which may be covered with it of the required thickness. When the surfaces have been carefully prepared the silver plate is coated with a strong solution of borax and applied to the ingot. They are then firmly bound with iron-wire, and subjected to a strong heat in a plating-furnace. When the fusing-point is almost reached the act of soldering takes place, and they are immediately removed from the furnace. The plate is afterwards brought to the required thickness in a rolling-mill, the silver and the alloy maintaining the same proportionate thickness throughout. Ornamental borders and mouldings are made separately of thin silver, and filled with lead.

PLATINUM is a metal of modern discovery, and owes its name to the idea at first entertained of its being related to silver, it being a diminutive of the Spanish word *plata*. We shall first describe its ore, denominated in mineralogy *native platinum*. It occurs in very small, irregularly formed grains, of uneven surface, usually flattened, and having the appearance of being worn by attrition. They are destitute of cleavage, and possessed of a hackly fracture; lustre metallic; colour perfect steel-gray; streak unchanged and shining; ductile; hardness a little above that of fluor-spar; specific gravity 17.3. It generally contains a little iron, and is accompanied besides by iridium, osmium, rhodium, palladium, ruthenium, and also sometimes by copper, chromium, and titanium. It is very refractory, and soluble only in nitromuriatic acid. The pieces in which it occurs rarely exceed a few grains in weight. It has been found principally in secondary deposits, and was first brought from Peru, and from Choco in New Grenada. It also occurs in various other localities; but it now comes in the largest quantity from Siberia, where it is found in the auriferous sands of Kushwa, in the Ural Mountains. The richest beds of these sands are from 2½ to 5 feet in thickness, and yield from 1 to 3 lbs. of metal for about 3700 lbs. of sand. Native platinum is also abundant on the western or Russian slope of the Ural Mountains. More recently it has been found in a syenitic rock, along with oxide of iron and gold. The grains in which it occurred possessed the same shape as those found in the sands. This locality is near Santa Rosa, in the province of Antioquia in Colombia.

The methods employed for obtaining the pure metal from its ore are two, namely, the method of Wollaston and the method of Debray and Deville. According to the former method the crude platinum is dissolved in aqua regia. The acid should be allowed to digest three or four days, with a heat which ought gradually to be raised. The solution, being then

poured off, should be suffered to stand until a quantity of fine pulverulent ore of iridium, suspended in the liquid, has completely subsided, and should then be mixed with a solution of chloride of ammonium (the salt being dissolved in five times its weight of water). A yellow precipitate of the double chloride of ammonium and platinum will immediately fall, which must be well washed in order to free it from the various impurities known to exist in native platinum, and must ultimately be well pressed in order to remove the last remnant of the washings. It is next to be heated with the utmost caution in a black lead pot, with so low a heat as just to expel the whole of the chloride of ammonium, and to occasion the particles of platinum to cohere as little as possible; for on this depends the ultimate ductility of the product. When turned out of the crucible it will be found of a gray colour, and if prepared with due precaution, lightly coherent. It now requires to be rubbed between the hands, in order to procure, by the gentlest means, as much as can possibly be so obtained of metallic powder, so fine as to pass through a fine lawn sieve. The coarser parts are then to be ground in a wooden bowl with a wooden pestle, but on no account with any harder material, capable of burnishing the particles of platinum (because burnished particles of platinum will not weld); and, indeed, every degree of burnishing would prevent the particles from cohering in the further stages of the process. And since platinum cannot be fused at any ordinary furnace heat, and consequently cannot be freed like other metals from its impurities during igneous fusion by fluxes, nor be rendered homogeneous by liquefaction, mechanical diffusion through water should here be made to answer, as far as may be, the purposes of melting, in allowing earthy matters to come to the surface by their lightness, and in making the solvent powers of water effect, as far as possible, the purifying powers of borax and other fluxes, in removing soluble oxides. By repeated washing, shaking, and decanting, the finer parts of the gray powder of platinum may be obtained as pure as other metals are rendered by the various processes of metallurgy; and if now poured over, and allowed to subside in a clean basin, a uniform mud or pulp will be obtained, ready for the further process of casting. The mould to be used for casting the metallic powder is a brass barrel, 6½ inches long, turned rather taper within, with a view to facilitate the extraction of the ingot to be formed, being 1.12 inch in diameter at top, and 1.23 inch at ¼ inch from the bottom, and plugged at its larger extremity with a stopper of steel, that enters the barrel to the depth of ½ inch. The inside of the mould being now well greased with a little lard, and the stopper being fitted tight into the barrel by surrounding it with blotting paper (for the paper facilitates the extraction of the stopper, and allows the escape of water during compression), the barrel is to be set upright in a jug of water, and is itself to be filled with that fluid. It is next to be filled quite full with the mud of platinum, which, subsiding to the bottom of the water, is sure to fill the barrel without cavities, and with uniformity—a uniformity to be rendered perfect by subsequent pressure. In order, however, to guard effectually against cavities, the barrel may be weighed after filling it, and the actual weight of its contents being thus ascertained may be compared with that weight of platinum and water which it is known by estimate that the barrel ought to contain. A circular piece of soft paper first, and then of woollen cloth, being laid upon the surface of the barrel, allow the water to pass during partial compression by the force of the hand with a wooden plug. A circular plate of copper is then placed upon the top, and thus sufficient

consistency is given to the contents to allow of the barrel being laid horizontally in a forcing press. After compression, which is to be carried to the utmost limits, the stopper at the extremity being taken out, the cake of platinum will easily be removed owing to the conical form of the barrel; and being now so hard and firm that it may be handled without danger of breaking, it is to be placed upon a charcoal fire, and there heated to redness, in order to drive off moisture, burn off grease, and give to it a firmer degree of cohesion. The cake is next to be heated in a wind-furnace, and for this purpose it is to be raised upon an earthen stand, about $2\frac{1}{2}$ inches above the grate of the furnace, the stand being strewn over with a layer of clean quartzose sand, on which the cake is to be placed, standing upright on one of its ends. It is then to be covered with an inverted cylindrical pot of the most refractory crucible ware, resting at its open end on the layer of sand, and care is to be taken that the sides of the pot do not touch the cake. To prevent the blistering of the platinum by heat, which is the usual defect of this metal in its unmanufactured state, it is essential to expose the cake to the most intense heat that a wind-furnace can be made to receive, more intense than the platinum can well be required to bear under any subsequent treatment, so that all impurities may be totally driven off. The furnace is fed with coke, and the action of the fire maintained for about twenty minutes from the time of lighting it. The cake is now to be removed from the furnace, and being placed upright upon an anvil, is to be struck, while hot, upon the top, with a heavy hammer, so as at one beating effectually to close the metal. If in this process the cylinder should become bent it must on no account be hammered on the side, by which treatment it would be cracked immediately, but must be straightened by blows given upon the extremities, dexterously directed, so as to reduce to a straight line the parts that project. The ingot of platinum when cold may be reduced by the processes of heating and forging, like any other metal, to any form that may be required. After forging, the ingot is to be cleaned from the ferruginous scales which its surface is apt to contract in the fire, by smearing over its surface with a moistened mixture of equal parts, by measure, of crystallized borax and common salt of tartar, which, when in fusion, is a ready solvent of such impurities, while it does not act, like caustic potash, upon the platinum itself. It is then to be exposed upon a platinum tray, under an inverted pot, to the heat of a wind-furnace. The ingot may then be flattened into leaf, drawn into wire, or submitted to any of the processes of which the most ductile metals are capable. The mean specific gravity of the metallic cake of platinum powder, when taken from the press, is 10; that of the cake fully contracted by heat, before forging, is from 17 to 17.7; that after forging is about 21.25; and that of wire 21.5, being the maximum density of this metal.

The process of Deville and Debray differs entirely from that just described. It consists in forming an easily fusible alloy of lead and platinum, and then removing the lead by cupellation. The platinum ore, mixed with an equal weight of galena, is introduced into a small reverberatory furnace, where it is strongly heated, litharge being added from time to time. The sulphur of the galena is gradually expelled, while the reduced lead unites with the platinum to form an alloy which is liquid at the temperature of the furnace. The foreign metals sink to the bottom of the furnace. The liquid alloy is now removed and submitted to the process of cupellation in the ordinary way, whereby the lead is removed. The crude platinum is now refined by fusion at the temperature of the oxyhydrogen flame. For this purpose the metal

is placed in a crucible made of well-burned lime, and the nozzle of the blowpipe is arranged so that the flame shall play around this crucible. By this means the metal is quickly melted, in which state it may be cast into ingots.

Pure platinum has a white colour, very much like that of silver, but it is inferior in lustre to that metal. Its malleability is far less than that of gold or silver, but superior to that of tin. It may be drawn into wires not thicker than the 2000th part of an inch. It is a soft metal, and, like iron, admits of being welded at a high temperature. A wire one-tenth of an inch supports 590 lbs. without breaking. As a conductor of heat it ranks between gold and silver. It undergoes no change from the combined agency of air and moisture, and it may be exposed to the strongest heat of a smith's forge without suffering either oxidation or fusion. On heating a small wire of it by means of galvanism or the oxyhydrogen blowpipe, it is fused, and afterwards burns with the emission of sparks. Platinum is not attacked by any of the pure acids. Its only solvents are chlorine and nitro-muriatic acid, which act upon it with greater difficulty than on gold. The resulting orange-red coloured liquid, from which the excess of acid should be expelled by cautious evaporation, contains tetrachloride of platinum. Platinum in a finely divided state has the power of absorbing and condensing large quantities of gases. By taking advantage of this fact chemical action may sometimes be brought about between gases which, under ordinary circumstances, do not react upon each other. Thus if a mixture of oxygen and sulphur-dioxide be passed over heated spongy platinum, as the finely divided metal is called, they unite to form sulphur-trioxide. So if a jet of hydrogen be allowed to impinge upon spongy platinum it is soon ignited, because the platinum has absorbed and condensed on its own surface a large amount of atmospheric oxygen, with which the hydrogen is brought into such close contact that combination takes place.

On account of its great infusibility, and its power generally of withstanding the action of chemical reagents, platinum is much used as a material for making vessels to be used in the chemical laboratory. Crucibles, evaporating dishes, &c., are very often made of platinum; so also the large stills used for the evaporation of sulphuric acid (which see) are made of this metal. Much platinum is now also used in electric apparatus, in the platinotype process in photography, in dentistry, &c. Easily reducible oxides, such as oxide of lead, must not be heated in platinum vessels, neither must they be exposed to the action of moist chlorine, of hot caustic potash, of aqua regia, &c.

The useful alloys of platinum are not numerous. With silver it forms a tolerably fusible white alloy, malleable and brilliant when polished; but it scales and blackens by working. Gold, by a forge heat, combines with platinum, and the alloys, in all proportions, are more fusible than the latter metal. In the proportion of 88 gra. to 1 oz. it forms a yellowish white, ductile, hard alloy; it is so elastic after hammering that it has been proposed to use it for watch-springs. Mercury, by trituration with spongy platinum, forms an amalgam at first soft, but which soon becomes firm, and has been much used in obtaining malleable platinum. A coating of platinum can be given to copper and other metals by applying to them an amalgam of spongy platinum, and 5 parts of mercury; the latter metal is then volatilized by heat. Lead combines with platinum readily; and iron and copper in like manner; the last mentioned, when added in the proportion of 7 to 16 of platinum and 1 of zinc, and fused in a crucible under charcoal

powder, forms the alloy called artificial gold. Steel unites with platinum in all proportions, and especially in the proportion of from 1 to 3 per cent. of platinum, forms a tough and tenacious alloy, well adapted for cutting instruments. Arsenic unites easily with platinum, and was once employed for rendering the latter metal fusible. An alloy of platinum, iridium, and rhodium is used for making crucibles, &c. It is harder than pure platinum, is less easily attacked by chemical reagents, and bears a higher temperature without fusing.

Platinum forms two chlorides, *platinous chloride*, $PtCl_2$, and *platinic chloride*, $PtCl_4$. The latter is often used in the laboratory as a test for potassium salts; it is produced by dissolving the metal in aqua regia, and removing the nitric acid by repeated evaporation with hydrochloric acid. The oxides of platinum are likewise two in number, *platinous oxide*, PtO , and *platinic oxide*, PtO_2 . This metal forms a very interesting series of so-called *platin-ammonia compounds*, in which varying amounts of ammonia are united with either a platinous or platinic salt; thus we have *diammonio-platinous chloride*, $2NH_3 \cdot PtCl_2$; *diammonio-platinic chloride*, $2NH_3 \cdot PtCl_4$; and so on.

PLATO, the disciple of Socrates, and founder of one of the great schools of Greek philosophy. It was during the political decline of Athens, in the period of Spartan and Theban ascendancy, and of the rise of the Macedonian power, that Plato flourished. The few particulars of his life which have been preserved are involved in considerable obscurity and uncertainty, while the scope they afford for amplification, as well as the great interest attaching to them, has led to many apocryphal additions being made to them, whether in the form of inference or of pure invention. He was, as is supposed, the son of Ariston and Perictione, and was born at Athens or in the Island of Ægina, probably on 27th May, a.c. 430 or 427. He was originally named Aristocles, after his grandfather. His father claimed descent from Codrus, his mother from a relative of Solon. His maternal uncles Critias and Charmides were disciples and companions of Socrates. Plato appears to have been instructed in the principal sciences of the day, particularly grammar, music, and gymnastics, by the best masters. The names of several of his instructors are given, but not all on unquestioned authority. Aristo of Argos, his teacher of gymnastics, is said to have given him the name of Plato on account of the breadth of his shoulders. There are other accounts of the origin of this name. In his youth he is said to have contended in the Isthmian and other games, and to have made attempts in epic, lyric, and dithyrambic poetry. He is also supposed to have served in some campaigns, and by law he would be liable to military service at the age of eighteen. Before becoming acquainted with Socrates he appears to have been instructed in the doctrines of Heraclitus by Cratylus, and he was probably not unacquainted with other current systems of philosophy. It was by common accounts in his twentieth year that he came directly under the influence of Socrates, and from this time he gave himself entirely to philosophy, destroying, it is said, his early poetical compositions. Until the death of Socrates (a.c. 399) he appears to have been his constant and favourite pupil. There are indeed no precise accounts of his intercourse with Socrates, but his own writings afford the best evidence of its intimacy. The death of Socrates forms the second turning-point in the life of Plato. Plato was present at the trial, and offered to guarantee any fine to which Socrates might be subjected. He is said to have attempted to speak, but to have been put down by the judges. He was absent from Athens on the day of Socrates'

death, and did not hear his last conversations. After the death of Socrates Plato left Athens, betaking himself first with other disciples of Socrates to Megara at Megara. Whether he returned to Athens before his subsequent journeys is uncertain. Friendship for Theodorus, or the desire to perfect himself in mathematics, led him to Cyrene, where he spent some time in studying mathematics under Theodorus. He then visited Egypt, where he studied astronomy; perhaps Asia Minor; the Greek cities of Lower Italy, apparently to acquaint himself with the doctrine and social organization of the Pythagoreans; and Sicily. The order and purpose of these journeys are differently related; some of them are questioned altogether. While some have attributed to him a design, in itself highly probable, to make himself acquainted with all the learning of his day by personal visits to its chief seats, and have without evidence extended his tour by supposed visits to the Hebrews, Babylonians, Assyrians, Persians, &c., from the knowledge of their institutions contained in his works, others have failed to find in these any distinct traces of information acquired even in his authentic journeys which might not have been attained at Athens. His first visit to Sicily took place when he was about forty years of age. He converted Dion, the brother-in-law of Dionysius the Elder, to his views; but Dionysius, according to the common reports, resented his admonitions, treated him as a prisoner of war, and sold him to the Spartan ambassador Pollis, from whom he was rescued by the Cyrenian Annioera. This story is of doubtful authenticity. About a.c. 389 or 388 Plato returned to Athens, and began to teach in the gymnasium of the Academy, situated outside the city in a north-westerly direction, and about 6 or 8 stadia from the Dipylum Gate, and in his own garden at Colonus, in the immediate neighbourhood. He appears to have had a patrimony sufficient for his wants, and taught without remuneration. The inner circle of his disciples, who numbered about twenty-eight, assembled at simple meals in his garden. Plato's teaching was interrupted by two visits to Syracuse, the first on the accession of Dionysius II., in order to instruct him in philosophy; the second in a.c. 361, to reconcile Dion with Dionysius. His efforts on both occasions were unsuccessful, and on the latter he owed his own safety only to the earnest intercession of Archytas. During his absence his place was supplied by one of his more intimate pupils, of whom Heraclides Ponticus is named. With this exception the whole of the remainder of his life was spent at Athens in giving instruction and composing his works. He died a.c. 347, in the eighty-first or eighty-fourth year of his age. By his will his garden remained the property of his school. He is said to have died while writing; by others at a marriage feast.

Plato was in personal appearance distinguished by manly beauty. His mind was endowed with the highest qualities. To a creative imagination of the first order he added logical, analytical, and constructive powers of equal eminence. Above all he was penetrated with the conviction of a harmony in the universe of being which led to the conception of a high ideal of life, and supplied him with the strength of purpose consistently to maintain it. This he probably owed to his connection with Socrates; and towards the close of his life he is said to have declared it a happy dispensation for him which had made him a contemporary of Socrates. One of the finest traits in the character of Plato was his unswerving devotion to his great teacher. After the death of Socrates the elder philosopher assumed a kind of sacred and ideal character as the personification of philosophical wisdom in the teaching of his disciple. The whole

of the writings of Plato, which are in the form of dialogues, are dominated by this character. Socrates plays the chief part throughout, while he himself is only once or twice mentioned. It is thus often a matter of difficulty to distinguish between the original teaching of Socrates and the corrections or developments of Plato. As far as Plato himself is concerned, it is by no means necessary that this should be done. As he has chosen to identify himself with the teaching of his master, it would serve little purpose to draw a distinction which he has not himself cared to make. It may, however, be observed generally that that for which Plato seems chiefly indebted to Socrates is the central ethical purpose which distinguishes alike the doctrine of both philosophers, and that the bolder speculations and more daring metaphysical developments of the joint system are his own.

The works of Plato, which were only supplementary to his oral teaching, have, by the dutiful care of his disciples, been preserved intact. This has not prevented their admixture with some of the works of his earlier disciples, and even of some of a considerably later date, which has rendered the work of identification one of some difficulty, and has led to considerable difference of opinion in regard to some treatises. Those works which have been mentioned by Aristotle are generally considered as the best attested, but this is not always regarded by critics. The reputed works of Plato consist of Dialogues and Letters. The latter are generally regarded as spurious, though some of them were probably composed by immediate disciples of Plato. The order of composition of the Dialogues is also a matter of much importance and of great difficulty. Aristophanes of Byzantium arranged them in trilogies; Thrasyllus, the neo-Pythagorean, in the time of the Emperor Tiberius, in nine tetralogies, as follows: 1, *Euthyphron*, *Apologia*, *Crito*, *Phædo*; 2, *Cratylus*, *Theætetus*, *Sophistes*, *Politicus*; 3, *Parmenides*, *Philebus*, *Convivium* (*Banquet*), *Phædrus*; 4, *Alcibiades* 1 and 2, *Hipparchus*, and *Anterastæ*; 5, *Theages*, *Charmides*, *Laches*, *Lysis*; 6, *Euthydemus*, *Protagoras*, *Gorgias*, *Meno*; 7, *Hippias* major and minor, 10, *Menexenus*; 8, *Cleitophon*, *Republic*, *Timæus*, *Critias*; 9, *Minos*, *Leges* (*Laws*), *Epinomis*, *Epistolæ* (*Letters*). The first attempt at a more critical arrangement was made by Schleiermacher, who adopted a didactic arrangement into three divisions, in the first of which Plato's special doctrine of ideas is contained in germ; in the second the difference between the common and philosophical conception of things is dialectically treated; in the third the practical doctrines of his philosophy are developed and completed. Brandis, who substantially agrees with Schleiermacher, observes that this arrangement does not necessarily imply a chronological order or a plan completely developed in advance in all its details. It is sufficient that Plato should have conceived the leading points of his system before adopting such a method of developing it, and he might at any time enrich any part of his plan with fresh discussions adapted to the degree of development attained in it. The leading works in Schleiermacher's first section are *Phædrus*, *Protagoras*, *Parmenides*; in the second, *Theætetus*, *Sophistes*, *Politicus*, *Phædo*, and *Philebus*; in the third, the *Republic*, *Timæus*, and *Critias* as principal, and the *Leges* as adjunct. Hermann has attempted to make out a chronological arrangement, and other scholars who differ from Schleiermacher have attempted various theories of constructive arrangement. These schemes in general proceed on the assumption that each dialogue, besides being an artistic whole, forms a link in a chain. This is denied by Grote, who does not admit that Plato

followed any plan either artistic or didactic. Each dialogue, according to him, represents the state of Plato's mind at the time it was composed, and it is not necessary to suppose that in writing the dialogues of research and inquiry Plato was already in possession of the solution contained in the constructive dialogues. The disturbing of prejudices and pointing out of difficulties has itself a value, and the dialogues of research present an end in themselves. The last observation is true, but Grote's application of it seems to do scanty justice both to Plato and his commentators, and to justify the complaint that Grote has treated Plato from the point of view of a historian rather than of a philosopher. The evidences of dialectic skill in preparing the mind of the inquirer by the difficulties contained in the earlier dialogues for the solutions presented in the later on this hypothesis go for nothing. The students of Plato are not prepared to reject these evidences, and it is clearly one thing to say that Plato's plan has not been discovered, and another to say that he had none. Susemihl adopts the intermediate view that Plato had a definite plan, but that it was only fully developed as he progressed.

In regard to the genuineness of the Dialogues attributed to Plato, the greater number of them is generally admitted, and all or nearly all of the disputed ones have some suffrages. The *Parmenides*, *Sophistes*, and *Politicus* are disputed by Socher; the *Menon* by Ast; the *Leges* by Zeller. These are defended by Hermann. Schleiermacher questions the *Minor Hippias*, the *Ion*, and the *Menexenus*, though admitted by Aristotle. The *Demodocus*, *Sisyphus*, *Eryxias*, *Axiochus*, were anciently regarded as spurious, and with them Brandis classes the *Hipparchus*, *Theages*, and *Definitions*. The spuriousness of all the letters is commonly regarded as demonstrated. Grote accepts as genuine all that was admitted as such by Thrasyllus.

The time when Plato began to compose his Dialogues is uncertain. Some attribute the composition of the earliest class to a period anterior to the death of Socrates; others, having regard to the idealization of the character of Socrates which pervades them all, hold their commencement to be subsequent to that event. On this view the *Apologia* is regarded as one of the earliest, and it is generally allowed to contain a historical and substantially faithful account of the defence of Socrates. Ueberweg supposes that Plato began to write his Dialogues about the time of the opening of the Academy, and that, omitting minor dialogues, they were probably written in the following order:—*Phædrus*, *Banquet*, *Protagoras*, *Gorgias*, *Meno*, *Republic*, *Timæus*, *Critias*, *Phædo*, *Cratylus*, *Theætetus*, *Philebus*, *Leges*; the *Apologia* he considers to be early and faithful.

The philosophy of Plato, whether considered in itself or in connection with the circumstances in which it arose, must be regarded as one of the greatest and noblest efforts ever made by the human mind to compass the problem of life. An important element in the examination of it is the method of Plato's teaching. As this was nearly the opposite of what is commonly considered essential in modern method, unless it is fully realized great injustice is certain to be done to his treatment of the various problems he discusses.

After the example of Socrates, Plato held the great end of philosophic teaching to be to lead the mind of the inquirer to the discovery of truth rather than to impart it dogmatically, and for this end he held oral teaching to be superior to writing, not merely as in modern practice for enlarging upon and explaining a written text, but in the direct pursuit of philosophical investigation. This preference

appears to have determined the form of his work, and that form is justified by his unrivalled skill in the management of the philosophic dialogue, to which he imparts the charms of poetry and dramatic representation. In the *Phaedrus* he says 'every writing resolves itself in effect into a means of recollection for him who already knows if questioned it does not answer; if attacked it cannot defend itself. Any discourse traced by the hand is therefore a work of comparatively little weight—an imperfect recollection mingled with frivolity. The only legitimate and fertile child of thought is a discourse on the just and the beautiful written on the soul.'

The question here is not as to the comparative advantages and inconveniences of such a mode of instruction, but as to the effect it has had on Plato's writings, and consequently on what is known of his system. One thing, however, appears evident, that the teachers are few who could dare to trust themselves to such a method. Plato's oral teaching, like his writings, appears to have been chiefly conversational. He was distinguished by fluency of speech to a degree which has suggested this quality as one of the explanations of his name. But it is also on record that he sometimes delivered formal discourses or orations. Themistius mentions his delivering a lecture on the Good in the Piræus before an audience which gradually dwindled away. Aristotle has preserved a fragment of a lecture on this subject.

Plato has acted undesignedly as the historian of earlier Greek philosophy. His writings contain lively and accurate accounts of previous systems and their teachers, introduced not merely for historical purposes, but incidentally to the analysis of their opinions in the search of truth. He also freely analyzed the poets, and he censured the best of them for want of clear ideas and true insight. Homer and Hesiod are excluded from his republic. The imaginative element entered largely into Plato's own teaching. He made use of myths as a means of facilitating the apprehension of his doctrines; but the instrument which he held alone adequate to the attainment of philosophical cognition was the method of dialectic, which he may be said to have been the first to employ scientifically in philosophy. In discoursing on this method he vividly recalls the dramatic representations of wisdom in the Proverbs of Solomon. Wisdom is the attribute of the Godhead, the love of wisdom, the distinction of the intellectual man, and the greatest good to which he can attain. When we strive after wisdom with the intensity of a lover she becomes the true consecration and purification of the soul. This aspiration implies an original relation of the soul to the source of true being, and its development he terms dialectic. The partial solutions of the problem of human knowledge which had been given by the earlier systems of Greek philosophy ended in paradoxical and contradictory conclusions, which had produced the scepticism of the Sophists. Socrates combated these on ethical grounds. Plato took up the contention, and carried the war, as it were, into the enemy's camp, by attempting anew on broader grounds, and by a surer method, the search into the foundations of knowledge. His dialectic had to clear its way between the sensualism of Protagoras, whose doctrine of eternal generation made all things subject to incessant change, and left no real existence of which there could be any knowledge, and no permanent possibility of knowledge itself, and the Eleatic doctrine of the unconditional unity of existence, which made all change merely phenomenal and non-existent. Plato combated these hypothetical systems by a strict analysis of knowledge, of which he distinguished the subjective and objective elements. He also originated the distinc-

tion of philosophy into the three branches of ethics, physics, and dialectic, although these names were first applied by his disciple Xenocrates.

The cardinal principle of Plato's dialectical system is the doctrine of ideas, and unfortunately his method of developing his principles has left some room for doubt or misunderstanding as to what this doctrine really was. Differences upon the subject began early, and different opinions are still expressed by critics. It does not appear, however, that the means of solution are actually wanting. This doctrine so pervades the entire system of Plato—dialectic, ethics, and physics, of all of which it is the fertilizing or creative principle, that if we give a due attention to its place in each we can hardly miss a substantially accurate conception of it. We do not, indeed, mean to say Plato has succeeded in developing his doctrine with perfect consistency and completeness, or that by means of it he has been able to erect a perfectly harmonious, uniform, and interdependent system of ethics, physics, and dialectic. It was much to attempt this, and the attempt has clearly been made. Notwithstanding the very different conditions of ancient and modern philosophy, the want of a directly systematic exposition, and the veil of allegory with which, like a still greater teacher, he has surrounded his doctrine, it has been made with a distinctness which can be traced even now. From a comparison of various statements which Plato has made respecting ideas, a theory of them may be traced in relation to the various parts of his system, more coherent perhaps than a hostile criticism, which insists on a literal interpretation of every passage, would be willing to allow, but which, if it contains nothing but what Plato actually taught, may, as an outline of his doctrine, be more just and adequate than any partial views of it however literally expressed.

Respecting the historical origin of the doctrine of ideas Aristotle has left an interesting statement, which renders it probable that it was during the lifetime of Socrates that it was first conceived. Plato, he says, derived from Cratylus, the Heraclitean, the doctrine that the sensuous is subject to perpetual change. This he ever afterwards maintained, and when he learned from Socrates of conceptions, which, when once rightly defined, remain for ever invariable, he believed that their counterparts must not be sought in the sensuous world, but that there must be other existences which were the objects of conceptual cognition, and these objects he named ideas. Euclid of Megara has also been credited with exercising a considerable influence on the development of his views.

The philosophical genesis of the doctrine of ideas is not uncertain. It was in the human mind and in the analysis of its conceptions that Plato found it. The word had been used before his time, and has been used since to signify the mental image by which an object of sense is reproduced in the mind. This is not Plato's idea. Such an image is merely the concrete conception, Plato's idea is derived from an analysis of conception. It represents, as indicated in the passage in Aristotle above referred to, the immutable element in conception. Here, however, a misunderstanding is apt to arise from the terms employed in modern philosophy. It is common now to analyze conception or cognition into two elements, the universal or invariable, and the particular or variable; the former is the *ego* or subject considered apart from the matter or object of cognition. This distinction is not that of the Platonic analysis. It is not the relation of the mind to the conception, but the particular conception itself, whether in or out of the mind, that is the subject of it. In this conception, in each such conception, Plato finds an immu-

table element which he calls its *idea*. This he illustrates in many ways, and in regard to a great variety of subjects. That which forms, perhaps, the basis on which the Platonic structure has been reared, and which best serves to illustrate its distinctive principle, is the case of opposite or contrasted conceptions. In the statement that Simmias is large in comparison with Socrates, but small in comparison with Phaedo, we appear to view largeness and smallness as purely relative conceptions, since in the one case we predicate the one and in the other case the other of the same individual. But when we subject these conceptions to the scrutiny of reason we find that they cannot be wholly relative. The comparative implies the positive, for unless there were something absolute and immutable in the conception of largeness it could not be compared with smallness or anything else. If the conception were transient in the individual mind the comparison would be transient also, and an object which was conceived of at one time as relatively large in comparison with another, might be conceived of at another as relatively small in comparison with the same object; or if the conception varied in different minds the ground of the comparison would vary in like manner. But largeness is always conceived of as bearing the same relation to smallness, and we mean the same thing in the above comparison when we say that Simmias is larger than Socrates, as when we say that Phaedo is larger than Simmias. There must therefore be something positive in the conceptions both of largeness and smallness to allow of their being thus constantly opposed; but this cannot be the particular amount of largeness contained in Simmias, seeing he is large in the one case and small in the other. Hence Plato distinguishes between the concrete quality as conceived to exist in an object, and the idea of the quality. The former is mutable, the latter immutable; but the quality always partakes of the idea, otherwise it would cease to exist. It makes no difference to this analysis whether the qualities we analyze are simple or complex considered as qualities, that is to say, whether we can resolve them into other qualities or not. If we suppose in the instance we have taken that greatness and smallness are resolvable into the common quality or condition of size, combined with more or less, then the same observations apply to more or less, as have already been made in regard to greatness and smallness, and it is besides indispensable that in the comparison the conception more should be combined with size, and not with something else, otherwise we might as well compare greatness with death, and smallness with blackness, as with each other. Complex conceptions have thus their immutable conditions, as well as simple ones; but in the case of such conceptions the latitude for variations of the quality within the scope of the idea may be very great. The idea of a triangle may include numerous forms, but all these must comply with certain conditions, or they would not be triangles. In like manner the ideas of justice, virtue, beauty, are immutably distinguished, whether we regard them as simple ideas entering into numerous combinations, which they distinguish by a common quality, or as combinations admitting of a great variety of forms. When the word justice is commonly used, it is used in the belief that there is a common conception underlying it, and this is to a great extent unquestionably true; but if any one should use the term justice without the common underlying conception, he would merely be designating a conception with a different underlying idea by the same name, and if he got a number of people to agree with him a confusion would arise from the same name being applied to two different things.

The case is precisely the same as if a heretical sect of mathematicians should set up the conception of a triangle with a break in the middle of one of its sides, making a triangular figure consisting of four lines, and not inclosing a space, and should persist in calling it a triangle.

This is the basis of the Platonic sphere of ideas, and some conception may already have been formed of its scope; but that conception would be inadequate if we omitted another fundamental condition of its development. If the question be asked, Where have we found these ideas? the answer undoubtedly is, In the human mind. They are there not in the form of concrete conceptions, but of necessary elements or conditions of these conceptions. Are they then purely subjective; is the necessity by which they arise a necessity which belongs to and inheres in the human mind alone? It is in handling this question that the greatness of Plato's conception of the mission of philosophy appears; it is in connection with it mainly that the obscurities which surround his exposition have arisen. Hitherto there is no essential difference between Plato and the modern school of idealists, between Plato, for example, and Kant; but the trouble is that Plato allegorizes his ideas: he gives them life and creative powers, he seats them on thrones in places beyond the vault of heaven; and in discussions more strictly dialectical he gives them an existence independent of time and space. Divested of the poetical surroundings, and with allowance made for the uncertainties and hesitation which may very well be allowed for in a philosophical investigation, both new in form and unparalleled in the vastness of its scope, the true dialectical development of Plato's views on this subject, we believe, amounts to nothing more than the assertion of the universal truth of ideas as the condition of intelligence. Plato's analysis does not stop short at human intelligence. He professes to analyze intelligence as such, and to show the conditions on which alone, whether finite or infinite, it is possible. Thus he asserts unhesitatingly the community of intelligence between God and man. That this is Plato's pretension may be gathered from various relative statements which he makes regarding ideas. While of ideas in themselves he predicates merely existence, through the activity of the Good he gives them causation according to their determinate natures; now of the Good itself, which is his highest idea, he says we can only imagine its activity as the activity of mind. But on what does this pretension rest? It cannot rest on anything higher than human knowledge; but in what manner it rests on human knowledge is worthy of attention. Whatever may be the limits of the sphere of human knowledge, we can conceive of knowledge beyond these limits. We cannot, of course, conceive in what such knowledge consists; but we can very well conceive of the possibility of its existence. We can also in some respects conceive of modes of knowledge different from those by which our knowledge is conditioned. We can conceive, for example, of the possibility of knowledge being communicated otherwise than by means of sensuous perceptions. Although wholly destitute of experience in these matters, there is nothing in the constitution of our minds that compels us to confine knowledge to such subjects and forms as our own experience has accustomed us to; but it is different with regard to such conditions of knowledge as we have been considering. We find that the constitution of our minds is such, that not only have we no experience to imagine knowledge without such conditions, but that our minds utterly refuse to admit the possibility of it under any conceivable circumstances whatsoever. We can conceive of intelligences who shall not think

of triangles at all; but not of intelligences who shall think of triangles with four sides, or of which all the angles are not equal to two right angles. Now this particular condition of human intelligence is that by which the whole of our knowledge is regulated. It produces a harmony and order throughout the whole sphere of our intelligence. All the objects within that intelligence, as well the natural objects with which we are acquainted as the conceptions that arise in our minds regarding these objects, or our relations to them, submit to its sway, and readily enter into the harmony it produces, and all the efforts of science to extend our knowledge have left these conditions of it undisturbed. Now we must either regard these conditions as being universal laws of intelligence to which the human mind is compelled to submit merely as intelligent, or we must regard them as peculiar to the human mind. In the latter case the whole fabric of our knowledge falls into ruin, for if these are not universal conditions of knowledge we condition our knowledge absolutely by something which is merely arbitrary and peculiar to ourselves, it becomes then a mere illusion and a dream, and we are, to borrow the phrase of a modern philosopher, not originally applied to mankind, mere incarnate absurdities. But if these conditions of intelligence are universal, it follows that they cannot be created by any intelligence, for no intelligence can exist without them. They therefore exist necessarily, not in themselves, but in intelligence. When Pascal speaks of the laws of mathematics as being created by God, and Kant of the conditions of human knowledge as being purely subjective, they assert limits to which in neither case is our reason able to submit. The doctrine of Plato has nothing in common with these principles of modern idealism. It is allied, on the contrary, to the opposite school of realism. It asserts an objective side to the subjective itself, and a true knowledge of the constitution of our own minds, without which all other knowledge would be impossible. The most instructive comparison we can suggest for Plato's doctrine of ideas, is the foundation on which Sir William Hamilton places his philosophy, that of the veracity of consciousness. The first principle in both cases is virtually the same, but it is differently tested and developed. With Sir William Hamilton it is merely passive and dogmatic. Unless consciousness is believed we cannot philosophize. With Plato brought to the test of reason it becomes an active, vitalizing, and creative principle, which serves to extend philosophy to its utmost limits.

In strict logical development, indeed, Plato's doctrine would require to be carried further than he carried it. All the elements of conceptions would be found in strict analysis to be equally immutable, and the element of mutability would be found to consist only in their combinations; thus when any new conceptions appeared they would be due either to the introduction of new elements or of new combinations. The objective existence of matter too would be as strictly proved by the veracity of our conceptions as the objective existence of mind, for our conceptions of matter as matter are as immutable in themselves as our conceptions of mind as mind. As long as the same form of matter is presented to our conception our conception of it is the same; and if our conceptions of matter vary more than our conceptions of mind it is because the object of them varies more. There is then a varying object presented to our conceptions, and the variations of our conceptions correspond truly to the variations of the object. The cardinal principle of Plato's doctrine then is the fundamental unity of intelligence. There may be infinite diversities in degrees of intelligence

and varieties in modes or media, but there can be no differences in kind of intelligence itself. In God or angel, man or beast, wherever it truly exists it is the same. God can give only what he possesses, and from the infinite Being down to the lowest organism which has the faintest flicker of intellectual light that light is one in substance. This logical extension of Plato's doctrine may be supposed to militate against Plato's argument for the immortality of the human soul, but it will injure it infinitely less than the drawing of an arbitrary line which annihilates the doctrine with all its consequences.

But if Plato failed to carry the logical development of his doctrine far enough down there was no want of boldness in an upward direction. Having discovered or created the realm of ideas he surveyed it throughout. He defined its most excellent forms as beauty, justice, and virtue, and having done so he determined what was the supreme and dominant principle of the whole. It is the idea of the Good. The harmony of intelligence throughout its entire extent with goodness, this is the highest attainment of Plato's philosophy. Beyond this it would be impossible to go; beyond this it would be impossible even to wish, for what could be conceived better than that infinite intelligence should correspond with goodness? It is with perfect consistency that Plato declares the idea of the Good to be superior to that of Being, for if goodness is the first condition of infinite intelligence it must comprehend Being as well as all other ideas which that intelligence contains. We do not, however, understand by Plato's idea of the Good the Deity himself, but only the abstract conception which comprehends the necessary condition of his existence. Plato, indeed, held the existence of an infinite intelligence whose highest attribute was goodness, and under whose government all things were ordered for good; but besides the necessity by the metaphysical process for reaching the abstraction before the reality there was a reason in the circumstances of his times why Plato should in his popular discourses dwell on the abstract idea rather than on the personal existence of God. There was no need to prove to an Athenian audience the existence of Deity. They had plenty of the personality of Deity; it was in the true conception of Deity they were wanting. Besides, Plato could not speak of a personal divinity different from those of the popular mythology without at once arousing enmity and opposition. The sphere of Deity was already occupied, that of abstraction was free. The circumstance already alluded to of Plato lecturing on the Good to a gradually diminishing audience—a picture in the history of philosophy worthy of the pencil of an artist—may be taken as an illustration of the practical relation of Plato's philosophy to the circumstances and wants of his time.

The ethical system of Plato was in direct dependence upon his dialectics, and will require little illustration. He believed that the ideas of all existing things were originally contained in God. These ideas were each the perfection of its kind, and as such were viewed by God with approval and love. God himself being infinitely good was the object of all imitation to intelligent beings, hence the ethics of Plato had a double foundation, the imitation of God and the realization of ideas, which were in each particular the models of perfection.

Plato's comical theories stood professedly on a different foundation from his dialectics and ethics. Matter did not come within the scope of his dialectical analysis. He had accepted a preconceived view of it which excluded it from dialectical treatment, consequently it had no place in his world of ideas, and no relation with God, upon whom they depended.

He consequently gave it an existence independent of God as a formless, passive, inert mass without qualities or conditions. To his cosmical theories he attributed only probability, holding that the dialectical method by which alone truth could be discovered was applicable only to ideas and the discovery of moral principles. The most valuable part of Plato's cosmogony is its first principle, that God, who is without envy, planned all things that they should be as nearly as possible like himself. He first made the soul of the world, which, being intermediate between the sensible and the intellectual, forms a connecting link between them. It is formed of two opposite principles, the one indivisible and immutable, the other mutable and divisible, and these are combined by an intermediate principle. To this soul he joined the material body. All things were created according to ideas, which were the perfection of each kind. Thus every individual in a species, for example, partakes of the idea of the species, but the individual is always inferior to the ideal. The soul of man, like the soul of the world, consists of three parts or elements. Plato attributes to it not only immortality but pre-existence. Sometimes this is predicated of the whole, sometimes only of the superior part. To the highest part of the soul, which has the head as its seat, he gives the cogitative powers and the desires appropriate to them; the intermediate part of the soul, having its seat in the heart, is distinguished by active impulses; the third part, with its seat in the bowels, by animal affections. Virtue, which is essentially one, has three distinct phases, corresponding to the threefold division of the soul. The virtue of the highest is wisdom, of the second courage, of the third temperance. The emotional part of the soul should govern the sensual and be under the government of the intellectual. Sexual love, separated from concupiscence, he regarded as a link between the sensual and the intellectual, and as consisting in an aspiration and perpetual striving after the immortal and eternal.

Plato's political treatises are the application of his ethical principles to social organization. In his Republic he does this without any regard to the practical, his object apparently being to sketch the ideal of a state which should serve as an abstract model of the things to be aimed at in social organization rather than to show how any particular object can be practically accomplished. The book of Laws is a sort of compromise between the speculative ideas of Plato and the actual state of society. He bases his Republic on the principle that the constitution of the state should correspond with that of the individual in order to allow the moral nature of the individual due scope for development. As he makes three parts of the soul, so he divides the state into three classes, the magisterial, the military, and the working, the last of which, like the sensuous part of the soul, is to be in complete subordination to the other two. The magisterial class is selected from among the middle class, the youth of which are to be carefully trained in science and virtue. The details are worked out into a multitude of arrangements, many of which are arbitrary, tyrannical, or impracticable. All art is excluded which does not consist in the imitation of the Good. Women receive the same education as men, and partake in their gymnastic exercises. Marriage and the intercourse of the sexes is the subject of very arbitrary and curious regulations. Of the three forms of government, monarchical, aristocratic, and democratic, he classes the first as best, the last as worst. The true king will always govern better than the law, for he will take account of particular cases and circumstances, but as his knowledge of these is limited the law is good as supplying particular principles, but it should depend ultimately on

the king. Laws consecrated by custom should be considered inviolable. But space will not permit us to give any adequate account of Plato's political theories, which are a mixture of things good, bad, and indifferent borrowed from all the various forms of government and social organisation, from theocracy to democracy, with original speculations, excellent in intention, but often arbitrary and chimerical, which have nevertheless been the fruitful source of subsequent speculations.

Plato's works were first published in Latin, in the translation of Marsilius Ficinus (Florence, 1483-84). The first edition of the text was by Aldus (Venice, 1513); the arrangement is that of Thrasyllus. An edition was published by Johannes Oporinus at Basel in 1534. The first good modern text is by Immanuel Bekker, published in 1816-18, with the Latin version of Ficinus, a critical commentary, and various readings; the arrangement is Schleiermacher's. There is an edition by Stallbaum (Leipzig, 1825), with subsequent reproductions; a Greek and Latin edition by Schneider and Hirschig (Paris, 1846-56); Greek by Hermann (Leipzig, 1851-53). Schleiermacher's translation (last edition, 1855-62) is the most celebrated German version. The French translation of Victor Cousin is distinguished by the excellence of style, which is a special characteristic both of author and translator. The best English version is by Professor Jowett (new edition 1892). Discussions on Plato's works, particularly by German scholars, and on particular works or parts of his system, are much too numerous to cite. The names of some of the leading critics have already been mentioned.

The followers of Plato have been divided into the old, middle, and new academies; or into five schools, the first representing the old, the second and third the middle, and the fourth and fifth the new academy. In the first are Speusippus, Xenocrates, and Heraclides, and others. The first reverted to pantheistic principles, the second to mysticism, and the last was chiefly distinguished as an astronomer. In the middle academy, of which were Arcesilas and Carneades, the founders of the second and third school, sceptical tendencies began to prevail. The new academy began with Philo of Larissa, founder of the fourth school; the fifth school was founded by his pupil Antiochus of Ascalon, who combined the doctrines of Plato with those of Aristotle and the Stoics, and prepared the way for neo-Platonism. The neo-Platonists ultimately became the antagonists of Christianity, to which among all the systems of ancient philosophy Platonism bears the strongest analogy. Platonic speculations still continued to appear among the early Christian fathers, but from the time of the establishment of the scholastic philosophy Platonism fell into complete discredit, and the philosophy of Aristotle was almost identified with the Christian religion, so that it became a sort of theological offence to question it. This eclipse of Platonism lasted till the Renaissance, when it again became the fashion for students of Greek literature to profess themselves Platonists, and from that time the philosophy of Plato has begun again to exercise its legitimate influence on human thought.

PLATOFF, or PLATOW, hetman of the Cossacks, was born in the southern part of Russia about 1763-65. He entered young into the military service, and in 1806 and 1807 he had the rank of lieutenant-general in the Russian army sent to the assistance of Prussia. He was afterwards employed against the Turks in Moldavia, and was made a general of cavalry. When the French invaded Russia in 1812 Platoff was again called into actual service, and though he was defeated at Grodno, and obliged to retire into the interior, he returned during the re-

troat of the enemy from Moscow, and with twenty regiments of Cossacks he harassed them in their flight, and contributed greatly to the advantages gained over them. In 1813, after the battle of Leipzig, he entered France, and was at Paris with the Emperor Alexander, whom he accompanied to England. At London he was the object of popular admiration, and a magnificent sabre was presented to him. In 1815 he commanded the Cossacks destined for the second invasion of France, and again made his appearance at Paris. After the restoration of peace he retired to Tcherkask, on the river Don, where he died in February, 1818.

PLATOON (French, *peloton*), a military term formerly used to designate a body of troops, usually half a company, who fired together. It is still used in the expression *platoon exercise*, which includes the manoeuvres connected with the handling and using of the rifle.

PLATTDEUTSCH, or **LOW GERMAN**, is the language of the North German lowlands, from the borders of Holland to those of Russian Poland. Its southern limit follows a line drawn through Aachen (Aix-la-Chapelle), Bonn, Cassel, Quedlinburg, Dessau, Wittenberg, Lützen, Fürstenberg, Meseritz, and Thorn. The northern boundary reaches the Danish frontier. The Dutch and Flemish languages also belong to the Low German dialects, but being associated with an independent political system, and having a literature of their own, are reckoned as distinct languages. The Low German dialects are distinguished from ordinary or classical German, and from other High German dialects, according to Grimm's Law (see **PHONOLOGY**), in that the former belong to his first, the latter to his second degree of consonantal changes. The consonants of the Low German are the same as those of the Gothic, English, and Scandinavian languages; hence one of the most simple and obvious distinctions between Low and High German is that the one dialect has *t* where the other has *s*, *k* for *ch*, *p* for *f*. The vowels vary much in the different Low German dialects, and cannot be taken for a distinctive mark.

Until the Reformation, Low German was the general written language of the district above described; from that time the issues from the press in that dialect became gradually fewer, and by the end of the seventeenth century they had ceased altogether, and even as a spoken language, within its former limits High German has ever since been slowly superseding the Low. The only considerable literary monument of the first period of the Low German is the *Heliand*, a poem ascribed to the ninth century. The second period is also poor in literary works, as the High German was patronized by the courts, and even poets born in Low German districts made use of it in their works. The Low German literature was thus mostly confined to matters of practical and everyday concern. It seldom rose above such compositions as rhymed chronicles, didactic poems, and books of law. In the higher regions of epic, lyric, and dramatic poetry the few works to which it could lay claim frequently possessed a flavour of popular wit and humour, but did not attain to the artistic excellence of contemporary High German poetry. Of the rhymed chronicles of this period we may mention the *Gandersheim Chronik des Pfaffen Everard* about 1216 (in Harenberg's *Historia Gandersheimensis*; Hanover, 1784); and *De Kronica van Sassen* (Brunswick, 1826). Among the law books the most celebrated is the *Sachsenspiegel*, which contains the sources of the Lübeck, Bremen, Brunswick, and other codes. Among dramas are the *Spiel van der Upstandinge*, edited by Ettmüller (1851), and the *Theophilus* by Hoffmann (1853). The lay of Vol. XI.

Koninc Ermenrikes Dôt, edited by Gödeke (1851), is a specimen of the heroic legends of the period. The Netherlandish poem *Reineke* and the *Eulenspiegel* (which see) are included by some as belonging to the close of this period. In the sixteenth century a considerable number of works appeared in Low German, chiefly historical and theological. Among them may be noted, *Die Pommersche Chronik* of Thomas Kantzow, edited by Böhmer; the *Chronik des Landes Dithmarschen* of Johann Adolph, surnamed *Neocorus*. The Low German Bible was printed in Lüneburg in 1622. In recent times Low German literature has received a new impetus from Klaus Groth and Fritz Reuter. Linguistically the Low German dialects have received a good deal of attention. A valuable lexicographical work dealing with the older period of the language is the *Mittelniederdeutsches Wörterbuch* of Schiller and Lübben (Bremen, 1878-81, 6 vols.); the modern period is represented in the *Bremisch-niedersächsisches Wörterbuch* of Tiling and others (1867-1869, 6 vols.); in *Berghaus's Sprachschatz der Sassen* (2 vols., 1878-82; never completed); and in *Doornkaat Koolmann's Wörterbuch der ostfriesischen Sprache* (1878). Of the carefully edited *Wörterbuch der niederdeutschen Sprache* of Kosegarten (Greifswald, 1857) only some parts have appeared. Among grammars are Lübben's *Mittelniederdeutsche Grammatik*; Ritter's *Grammatik der mecklenb. plattdeutschen Mundart*; Neger's *Grammatik des mecklenb. Dialekts*, &c.

PLATTE, a river in the United States, which rises in the Rocky Mountains by two branches, called respectively the north and south forks of the Platte. The North Platte is formed by the union of several streams in the North Park, Colorado, and the South Platte takes its rise in the South Park. They flow east, and unite 400 miles from their source, while the united stream, also flowing mostly east, falls into the Missouri on the frontier of Iowa, 15 miles below Omaha, after a course of about 1600 miles. Principal affluents, the Elk-horn and the Loup Fork. The river is from 1 to 3 miles broad, but is so shallow and encumbered with islands, and has such a rapid current, that it cannot be navigated. The South Platte in its upper course is extensively used for irrigation and as a source of power.

PLATTENSKE. See **BALATON** (LAKE OF).

PLATTSBURG, a town of the United States, capital of Clinton county, New York, on both sides of the Saranac, near its mouth in Cumberland Bay, on the west shore of Lake Champlain, 155 miles north of Albany. It has manufactures of leather, machinery, woollen and cotton cloth; numerous saw and other mills, and a considerable lake trade. Plattsburg has been selected as a military station, and large barracks have been erected on the shore of the lake in its vicinity. Some severe fighting, both by land and water, took place here in 1814, between the British and the Americans, to the advantage of the latter. Pop. (1890), 7010.

PLATYHELMINTHES, or **PLATYELMIA** ('Flat-worms'), one of the main groups into which the worms and their allies are now divided. These forms, which include both parasitic and non-parasitic animals, are primarily distinguished by the more or less flattened and compressed shape of their bodies. No segmentation or division of the body into segments or somites is seen—the apparent division of the body in the Tape-worms being not a real segmentation, since each of the joints or proglottides is in several respects a separate organism. The Platyhelminthes comprise the three classes of Turbellaria (see that article and **PLANARIANS**), Trematoda (which see), and Cestoda (see **TAPE-WORM**).

PLATYPUS. See **ORNITHORHYNCHUS**.

PLATYRHINA. See **MAMMALIA**, **MONKEYS**, **QUADRUMANA**.

PLAUEN, an important manufacturing town of Saxony, in the circle of Zwickau, on the left bank of the Elster, 78 miles w.s.w. of Dresden. It is mostly situated on a plateau rising above the river and divided into two unequal parts by a ravine. It has an old castle on a lofty site, a fine Gothic Protestant church, &c. It is the chief centre in Germany for the weaving of white cotton goods, and has mills for spinning yarn and thread, machine-works, calico printfields, dye-works, paper and other mills. Plauen is an ancient place, and in 1480 was pillaged by the Hussites. Pop. in 1880, 35,078; in 1895, 55,197.

PLAUTUS, **TITUS MACIUS**, one of the oldest Roman comic writers, was born at Sarsina, in Umbria, about B.C. 254; died about A.C. 184, as the manager of a company of players in Rome. Aulus Gellius tells us that for some time he was in a very destitute condition, and was compelled to earn his livelihood by turning a hand-mill. He must have possessed an inexhaustible fund of gaiety, since, even in a condition so unfavourable to poetry, he seems to have composed some comedies, the success of which appears to have enabled him to commence a literary career. About 180 plays were attributed to him in the time of Varro, but many of them were believed by critics to be spurious. Varro limited those undoubtedly genuine to twenty-one, although many others were admitted to have strong claims. About twenty of them, principally entire, have come down to us. The names are either borrowed from the persons of the piece, as *Amphitruo* (the husband of Alcmena, mother of Hercules), *Curculio* (Corn-worm, the name of a sponger), *Epidicus*, *Pseudolus*, *Stichus* (names of slaves), *Bacchides* (name of two frail fair ones), *Menæchmi* (the name of a pair of twins), *Miles Gloriosus* (the Braggart Soldier), *Captivi* (the Two Captives), *Mercator* (the Merchant), *Penulus* (the Carthaginian), *Persa* (the Persian), *Truculentus* (the Fierce); or from something which serves as a foundation of the play, as *Aulularia*, *Cistellaria*, *Mostellaria*, *Fabula* being understood (the Pot or the Treasure, the Casket, the Ghost). He took as his models the poets of the new Attic comedy, but he was essentially original, and his great popularity with the Romans, which continued after his death, was greatly due to his depicting Roman manners. The purity of his language and the refinement of his humour made him as much a favourite with scholars and critics as with the people. The *Amphitruo* has been imitated by Molière in his *Amphitryon*, and other modern dramatists have also copied him. The text of Plautus is very corrupt, and with frequent lacunæ and interpolations, many of the latter of modern origin. The first edition is that of Venice (1472). An excellent edition of the comedies of Plautus was issued by Ernesti (Leipzig, 1760, two vols.). Among modern editions may be mentioned those of Weise (1837–38, two vols.), and Leo (two vols., 1895–96), but the best is that of Ritschl (1848–53; revised and continued by Löwe, Götz, and Schöll, four vols., 1878–94; smaller edition by Götz and Schöll, seven vols., 1892–96). There are also various editions of separate plays. There are English translations by Thornton and Warner (1767–74), Riley (1880), and Sugden (1895).

PLAYFAIR, **JOHN**, natural philosopher and mathematician, the eldest son of James Playfair, minister of Benzie, in Forfarshire, was born there 10th March, 1748. He received his early education at home, and at the age of fourteen was sent to the University of St. Andrews to study for the church. While still a student he was selected by Professor Wilkie to lecture on natural philosophy to the pro-

fessor's class during his absence from ill health, and at the age of eighteen he became a candidate for the chair of mathematics in Marischal College, Aberdeen. On the death of his father in 1772 he was nominated as his successor, and entered on his charge in Aug. 1773. In 1779 he published in the sixty-eighth volume of the *Philosophical Transactions* of the Royal Society an *Essay on the Arithmetic of Impossible Quantities*. In 1782 he resigned his living to become tutor to the sons of Mr. Ferguson of Raith. In 1785 he was chosen by Adam Ferguson as assistant professor of mathematics in the University of Edinburgh. In 1787 he commenced a series of papers in the *Transactions* of the Royal Society of Edinburgh. In 1795 he published for the use of his class an edition of the *Elements* of Euclid, in which he used algebraical signs to abbreviate the demonstrations. This has become a text-book, and has been frequently edited. On the death of Dr. Hutton (1797) he commenced the study of his works with a view to a biography, but found greater attractions in the advocacy of his theory, which led to his *Illustrations of the Huttonian Theory of the Earth* (1802). In 1803 he published his *Biography of Hutton* in the *Transactions* of the Society. In 1805 he was appointed to the chair of natural philosophy, and became secretary of the Royal Society of Edinburgh. In 1807 he was admitted a member of the Royal Society of London, to which he presented *An Account of the Survey of Schehallien*. In 1812 and 1816 he published the first and second volumes of his *Outlines of Natural Philosophy*. The first volume treats of dynamics, mechanics, hydrostatics, hydraulics, aerostatics, and pneumatics; the second of astronomy; the third, which was to have embraced optics, electricity, and magnetism, was never published. He also wrote for the supplement to the *Encyclopædia Britannica* a *Dissertation on the Progress of Mathematical and Physical Science since the Revival of Letters in Europe*, published in 1816. This work, which was not completed, interrupted an improved edition of his *Illustrations of the Huttonian Theory*, which he was never able to complete.

In 1815 the establishment of peace enabled him to extend his scientific investigations to the Continent. He went to Paris in company with his nephew, travelled thence to Switzerland, where he made important geological investigations; he then entered Italy by the Simplon. He spent the winter in Rome, and in spring proceeded to Naples, where he made fresh geological investigations. He returned by Florence and Geneva, passing also through Venice, Lyons, and Paris. In the ensuing summer he prepared a treatise on *Naval Tactics*, referring to the discoveries of Clerk of Eldin, which was published after his death. The observations made on his tour, which were intended for the illustration of his work on the Huttonian Theory, were never utilized for that purpose, and were only partially published. He died of a strangury, with which he had been afflicted for some years, 19th July, 1819. According to Jeffrey, Playfair was not more eminent as a man of science than pleasing in his deportment in society, in which, without trying to shine, he attracted all of either sex with whom he came in contact, as much by his amiable qualities as by the intrinsic value and unaffected character of his conversation. Playfair was a frequent contributor to the *Edinburgh Review*, and his papers in the *Transactions* of the learned societies were very numerous, and embraced a great variety of subjects besides those enumerated.

PLAYING-CARDS. See **CARD**.

PLEA, in English law, is the answer of a defendant to a plaintiff's declaration. Pleas were divided into pleas of the crown and common pleas. The

former relate to criminal prosecutions, the latter to civil suits. A dilatory plea was a plea in objection to the jurisdiction of the court, or praying for the suspension of the action, or in abatement of the declaration. Peremptory pleas were pleas in bar of the action. The pleas formerly used in civil proceedings in the Superior Courts are now superseded by the *statement of defence* introduced under the Judicature Acts of 1873 and 1875. In criminal actions the prisoner's pleas are (a) objections to the jurisdiction; (b) in abatement; (c) formerly acquitted, convicted or pardoned; (d) the general issue of not guilty.

In Scotland what are called pleas in law have quite a different meaning. They were introduced by act 6 Geo. IV. cap. cxx. s. 9, which defines them as 'a short and concise note, drawn and signed by counsel, of the pleas in law by which the action or defence is to be maintained; and in such note the matters of law so to be stated shall be set forth in distinct and separate propositions without arguments, but accompanied by a reference to the authorities relied on.' These pleas are subjoined to the action or defence, and it is the statutory duty of the lord ordinary, before closing the record, to suggest any plea which he may deem necessary to be answered by either party in order to exhaust the case. As new pleas may be raised after the closing of the record by a process of enrolment, including forty-eight hours' notice to the opposite party, the object of the statute, to have the whole case clearly stated before beginning the debate, has not been fully answered, the motive for an exhaustive statement of the pleas in law before beginning the action not being sufficiently strong to secure uniformity of practice.

PLEADING is the process in English law by which the issues to be determined in an action are ascertained. These issues may either be issues of law to be determined by the court, or issues of fact to be brought before a jury. The art of pleading appears to have been introduced into England by the Normans, no stated method of procedure having been traced among the Anglo-Saxons. In former times pleadings were delivered orally, whence in old law French they are frequently termed the *parol*. The forms of process have been frequently modified by statute, the more important rules now in use in the High Court being settled by the Judicature Act of 1875 as follows—(a) Unless the defendant at the time of his appearance shall state that he does not require the delivery of a statement of complaint, the plaintiff shall within a specified time deliver to the defendant after his appearance a statement of his complaint, and the relief or remedy to which he claims he is entitled. The defendant on his part shall within a prescribed time deliver to the plaintiff a statement of his defence, set-off, or counter-claim, and the plaintiff shall in like manner deliver a statement of his reply to such defence, set-off, or counter-claim. Such statements shall be as brief as the nature of the case will admit, otherwise the expenses caused by unnecessary prolixity may be charged on the party using it. (b) Every pleading must contain a statement of the material facts on which the party pleading relies, but not the evidence by which they are to be proved. (c) Every allegation of fact in a pleading, if not denied specifically, by necessary implication, or stated to be not admitted in the pleading of the opposite party, shall be taken to be admitted, except as against an infant or person of unsound mind. (d) Each party in any pleading must allege all such facts not appearing in the previous pleadings as he means to rely on, and must raise all such grounds of defence or reply as the case may be, as if not raised on the pleadings would be

likely to take the opposite party by surprise, or would raise new issues of fact not arising out of the pleadings. (e) No pleading shall, except by way of amendment, raise any new ground of claim or contain any new allegation of fact inconsistent with the pleadings of the same party. (f) It shall not be sufficient for a defendant to deny generally the facts alleged by the statement of claim, or for a plaintiff to deny generally the facts alleged in a defence by way of counter-claim, but each party must deal specifically with each allegation of which he does not admit the truth.—If the plaintiff does not deliver his statement of claim within the prescribed time, the defendant, at the expiration of such time, may apply to the court or a judge to dismiss the action with costs, and the court or judge may order the action to be dismissed accordingly, or make some other order which the court or judge shall deem just. The law relating to pleading is practically the same in most of the United States.

PLEBEIANS (*Plèbs*), one of the great orders of the Roman people, corresponding to the commonalty in England. The time at which the Plebeians were recognized as a distinct order in the state is not ascertained; but they were at first excluded from nearly all the rights of citizenship. They differed from the *Clientes* in not being obliged to choose a patron, and were allowed to hold land by a free title, but had no share in the public domains; they were also obliged to serve in the army, but they were excluded from all public or political privileges. The whole government of the state, with the enjoyment of all its offices, belonged exclusively to the Patricians, with whom the Plebeians could not even intermarry. This was their condition under the monarchy. The civil history of Rome is subsequently to a great extent composed of the struggles of the Plebeians to assert their claim to the place in the commonwealth to which their numbers and social importance entitled them. When under Tullus Hostilius the Romans conquered Alba, they admitted the most distinguished of its citizens to the Patrician class, while the great bulk of them were added to the Plebeians. The same course was followed in other conquests, so that the numbers of the Plebeians were constantly augmenting, while they were for the most part of the same blood, and possessed of the same courage, determination, and other moral qualities as the dominant class, though less favourably developed by circumstances.

The Plebeians, like the Patricians, were divided into *gentes*, but they were excluded from the three Patrician tribes, and from the *curiæ*, which formed the basis of the governmental machinery of the state. Tarquinius Priscus seems to have made an attempt to introduce the Plebeians to the privileges of citizenship by dividing them into tribes, but it was not successful. Servius Tullius organized the Plebeians in tribes, of which he constituted four for the city and twenty-six for the surrounding subject territories. Each tribe had a tribune or prefect. They had their own social and religious privileges, and were allowed to meet in *comitia tributa* convoked by the tribunes. This organization under recognized heads, and the power of meeting, were of the greatest importance, and contained, as experience proved, the germ of all subsequent concessions. A semblance of political power was at the same time conferred on them by Servius Tullius. He divided the whole body of citizens into five classes according to the amount of their property, upon which division was founded the *comitia centuriata* or great national assembly, to which the greater part of the legislative and judicial power of the *comitia curiata* was transferred. The citizens, in this assembly, voted by centuries, but as the

equestrian order and the first class of citizens had the majority of the whole number of centuries, and voted first, it was only in the case of differences among them that it was necessary to consult the lower classes. Some of the noble Plebeian families were also admitted into the equestrian order. To follow the entire course of concessions which followed this beginning would demand an examination of the most complicated details of Roman history. The establishment of tribunes (B.C. 494), the law of the twelve tables (B.C. 451-450), the Lex Canuleia (B.C. 445), which permitted intermarriages; the admission to the consulate (B.C. 366), with the successive admission in B.C. 351 to the censorship, B.C. 336 to the prætorship, and B.C. 300 to the offices of pontifex and augur, were the leading steps in a succession of victories which culminated (B.C. 286) in the Lex Hortensia, which gave the plebiscita of the people the force of law. From this time the privileges of the two classes may be said to have been equal; the word *populus* now began to be used to designate the whole people, and *plebs* was employed sometimes to designate the assembly of the comitia centuriata, or popularly to distinguish the general mass of the common people.

PLEBISCITE, a form of voting introduced into France under the Napoleonic régime, and named after the Roman *plebiscita*. See ELECTION (POLITICAL).

PLECTOGNATHI, a sub-order of Teleostean fishes, distinguished by the maxillary and intermaxillary bones on each side of the jaw being firmly united together by bony union. The intermaxillary bones form the margin of the upper jaw, and they are thus soldered to the maxillaries; whilst the bones of the palate are also firmly joined to the skull. The union of the bones of the head is of a much more firm and intimate kind than in other Teleostean fishes. The head is of large size. The mouth is small, and the lips are hardly movable. The opercula or gill-covers are covered and surrounded by skin and membrane so as to limit in a very marked degree the gill or opercular opening. The body is generally of shortened conformation. The skin is usually of stout, horny texture, and may be covered by ganoid plates, scales, or by detached bony tubercles. The fins are small, and entirely soft. The ventral fins may be wanting. No pyloric cæca exist. The swimming or air bladder is a completely closed sac. As examples of the chief fishes included in this group we may cite the Trunk-fishes or Ostracodontids, the curious Balistids or File-fishes, the Globe-fishes (*Tetraodon* and *Diodon*), and the Sun-fishes or Orthogoriscid. See SUN-FISH and TRUNK-FISH.

The Globe-fishes, of which the *Tetraodon Pennantii* of the Cornwall coasts, the *T. lineatus* of Carolina, and the *T. lineatus* of the Nile may be cited as examples, are remarkable on account of the power they possess of distending the body at will with air, the air being forced into a large saccular expansion extending beneath the belly and opening from the œsophagus or gullet. Darwin says the air is swallowed, then forced into the sac, and retained there by muscular contraction. The possession of this inflated sac enables the fish to float on the surface of the water, belly upwards—a faculty by means of which it may possibly escape from its enemies which exist in greater depths—whilst the spines with which the skin is covered give to the fish an additional protection. These fishes are hence known as ‘Sea-porcupines.’ The allied genus *Diodon* is represented by various species, of which the *D. pilosus* may serve as a familiar example. The fishes belonging to this latter genus mostly occur in warm or tropical seas. See also OSTRACODONT.

PLEDGE, or **PAWN**, is a species of bailment, being the deposit or placing of goods as security for the payment of money borrowed, or the fulfilment of an obligation or promise. It is distinguished, in English law, from a mortgage of chattels by the circumstance that the legal property in the chattel mortgaged is in the mortgagee, whereas the legal ownership of goods pawned remains in the pawner, though according to the definition of a pawn and pledge the pawnee not only has the right of possession, but must be in possession. If the money is not paid at the time stipulated the pawn may be sold by the pawnee, who may retain enough of the proceeds to pay the debt intended to be secured. In some cases the terms of the deposit are the forfeiture of the pawn in case the pawner does not fulfil the promise or obligation to guarantee which the pawn is given. See PAWN-BROKER.

PLEIADES, the daughters of Atlas by Pleione, or the Oceanid Æthra. They were sisters of the Hyades, and seven in number. Six of them were visible, the seventh invisible. The seventh is called by some Sterope, by others Electra. She is variously said to have become invisible from shame or from grief. The sisters are said to have made away with themselves from grief at the death of the Hyades, and to have been placed in the stars as a cluster behind Taurus.

PLEONASM (Greek, *pleonasmus*, a redundancy), in rhetoric, is a figure of speech by which we use more words than seem absolutely necessary to convey our meaning, in order to express a thought with more grace or greater energy; it is sometimes also applied to a needless superabundance of words.

PLESIOSAURUS, a genus of extinct reptiles forming the type of the order Plesiosauria or Saur-opterygia (Owen). Of this genus upwards of twenty species have been described, and the remains of these reptiles occur from the Lias to the Cretaceous or Chalk rocks inclusive; these forms being thus exclusively of Mesozoic age. The length of the largest specimens average from 18 to 20 feet. Familiar species are the *Plesiosaurus dolichodermus* (see fig. at GEOLOGY) of the Lias formations, the *P. affinis* of the Upper Oolites, *P. Bernardi* of the Chalk. *P. macrocephalus*, *P. Hawkinsii*, *P. homalodondylus* of the Whitby Lias, *P. pachyomus*, &c. &c. The remains of this curious genus were first brought to light in the Lias of Lyme Regis in 1822. They were first noticed by Dean Conybeare and Sir H. De La Beche, who named them *Plesiosaurs* (*plesios*, near, *sauros*, lizard) for the reason that the genus was more nearly related to the lizards than the *Ichthyosaurus* (which see), another extinct reptilian form found in the same formation. Very perfectly preserved skeletons of Plesiosaurs have from time to time been discovered, and have been made the subject of important memoirs by Owen and other paleontologists. Cuvier regarded the structure of the Plesiosaurus as ‘the most singular, and its characters the most anomalous that had been discovered amid the ruins of a former world.’ Dr. Buckland, writing of this genus, describes its members as uniting to the head of a lizard ‘the teeth of a crocodile, a neck of enormous length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale.’ So far as can be ascertained from the careful examination of the fossilized remains no scales, plates, or other structures resembling an exo- or outer skeleton existed in the Plesiosaurs. The bodies of the vertebrae or joints of the spine were flat or slightly concave, or possessing a slight convexity in the middle of the concavity. The neural arches and spines of the vertebrae were not generally ossified to the vertebral bodies. Long

transverse processes existed on the vertebrae. The front ribs of the chest articulated with the vertebrae by simple and single or undivided heads. The cervical or neck vertebrae numbered forty or fewer. From twenty to twenty-five dorsal segments existed; and two sacral vertebrae and from thirty to forty caudal or tail segments completed the spine. No distinct breast-bone or sternum was developed, nor do sternal ribs appear to have existed; but certain ossifications were developed in the ventral or lower wall of the abdomen. These ossified pieces were arranged in transverse rows from before backwards, each row comprising a single median bone slightly bent upon itself, and of six other overlapping bones, three on each side. The head was not more than $\frac{1}{10}$ th or $\frac{1}{12}$ th of the length of the body. The neck was as elongated in some species relatively to the body as that of a swan, but in other species again it was proportionally shorter. The tail was relatively short, the fore limbs or paddles being shorter than the hinder members. The snout was of a tapering form. The orbits or eye-cavities were large and wide. The teeth were sharp and curved, the outer surfaces of their crowns being grooved. Each tooth was sunk in an alveolus or distinct socket. The eyes do not appear to have been strengthened by a circle of sclerotic or bony plates in the outer membrane of the eye, as in Ichthyosauri. The bones of the shoulder-girdle were formed by two large coracoid bones, two scapulae or shoulder-blades of peculiar conformation, two clavicles or collar-bones, and a bone variously regarded as an interclavicle or an episternal bone. Six bones existed in the wrist, and were arranged in two rows. The pelvis was well-developed; and both fore and hind limbs were in all probability inclosed within a membrane so as to form swimming paddles like those of existing Cetacea.

With regard to the habits of the Plesiosauri it may reasonably be inferred that these reptiles were aquatic and inhabited the estuaries of rivers and shallow waters, occasionally swimming out to sea. Their gait on land would necessarily be awkward and difficult. The elongated neck would serve to enable them to descry their prey from among or over the tops of the reeds and vegetation amid which they might lie concealed in the banks of rivers or in estuaries, whilst this same length of neck would adapt them for readily seizing their prey, which consisted probably in greater part of fishes.

Pliosaurus is an extinct reptile included in the same order with the Plesiosaurus, and distinguished chiefly by its greater size and by the larger head borne on a short neck. These latter reptiles occur as fossils in the middle and upper oolites only. The teeth were simple, conical in shape, and of large size. The neck vertebrae were compressed from before backwards, and thus resembled those of the Ichthyosauri. Some of these Pliosaurus attained a length of upwards of 40 feet, for example, *Pliosaurus brachydontus*. The tooth of *P. grandis* from the Kimmeridge clay of Oxford measured about 8 inches or more, its girth at the base of the crown being $7\frac{1}{2}$ inches, and its diameter at the same place being 2 inches 7 lines. In size this tooth resembles that of the living sperm whale.

PLETHORA, or HYPERÆMIA, is a condition of overfulness of the blood-vascular system, a condition in which there is obvious excess of blood in the body. It can hardly be called a disease. That is to say, the quantity of blood may be in excess of the normal, but its quality may be unaltered. On the other hand, there is a condition of plethora, called by pathologists *hydremic plethora*, in which there is not only excess in the total volume of blood, but the excess is due to retention of water, so that the blood is

more watery than usual. But the term plethora as ordinarily used signifies simply excess of blood.

Amputation is a frequent cause of plethora, as the digestive powers do not immediately accommodate themselves to the reduced wants of the system, and too much food is liable to be taken and too much blood formed. Plethora has two leading causes—the introduction into the vascular system of too much nutriment, and the deficient activity of tissue change in the various organs, whereby the nutritive matter is insufficiently removed from the blood. A tendency to plethora thus generally develops at an advanced age, when the activity of tissue processes has been considerably diminished. Plethora is often confounded with obesity, from which it is quite distinct. Plethoric persons, however, are usually unduly stout, much of the excess of nutritive material being deposited as fat under the skin. Plethora produces a diminution of activity and a greater tendency to sleep than in health; these symptoms increase as it becomes aggravated, and culminate in lassitude and vertigo, turgid countenance, suffused eyes, palpitations of the heart, and similar phenomena. The treatment of plethora is entirely negative, and is suggested by the causes of the disease. Abstinence and exercise are its two most important elements, and their combination depends upon the circumstances of the individual case. Generally abstinence from malt liquors, wines, or spirits is recommended.

PLEURA, the serous membrane (see MEMBRANE) lining the cavity of the thorax or chest, and which also covers the lungs. Each lung is invested by a separate pleura or portion of this membrane; the structure being spoken of rather as double pleurae than as a single membrane. Like all serous membranes, and as described in the article MEMBRANE, each pleura is a completely closed or shut sac, and does not communicate with its companion membrane; and it further resembles the other serous membranes in that one side or part of the sac lines the containing cavity, whilst the other part or fold is reflected over the contained organs. In the thorax, therefore, each pleura is found to consist of a portion lining the walls of the chest, this fold being named the *pleura costalis* or *parietal layer* of the pleura. The other fold, reflected upon the lung's surface, is named in contradistinction the *pleura pulmonalis*, or the *visceral layer*. These two folds inclose a space known as the *pleural cavity*, which in health contains serous fluid in just sufficient quantity to lubricate the surfaces of the pleurae as they glide over one another in the movements of respiration. The abnormal increase of the fluid of the serous sac constitutes the condition known as *hydrothorax* or pleural dropsy, whilst it may also contain air—as seen in cases where the lung has been wounded—constituting the lesion known as *pneumothorax*; or pus may be present in the pleural cavity, when the disease is known as *empyema*.

In front the two pleural sacs touch one another at a single point only, about the middle of the sternum, and they therefore inclose a space between them known as the *mediastinum*, which is again divided into anterior, middle, posterior portions. (See LUNG.) In the mediastinal space the heart and other organs of the chest are situated, excepting the lungs, which are contained, as already explained, each within its own pleural sac. The pleura lines the ribs laterally, and a portion of the sternum or breast-bone in front. From the breast-bone it passes backwards over the pericardium (which see), or sac inclosing the heart. From this latter point the membrane is reflected over the front portion of the root of each lung; the root being the portion of the lung near its middle and inner surface, where the great vessels, bronchial

tubes, and other structures enter the organ. A fold of the pleura, constituting the *ligamentum latum pulmonis*, or 'broad ligament of the lung,' passes downwards from the root of the lung to the diaphragm or 'midriff,' and serves to retain the lower part of the lung in proper position. The back portion of the root of the lung is next covered by the pleura, and thence it passes over the entire lung to the sides of the vertebræ and ribs, and thus reaches the sternum and point from which it started. Inferiorly the pleura covers the upper surface of the diaphragm. The apex of the pleura projects above into the neck about an inch above the border of the first rib. The pleura of the right side is wider, shorter, and extends higher in the neck than that of the left side. The outer aspect of the membrane adheres to the lung surface, and also to the pulmonary vessels as these leave the pericardium or heart-sac. It is also attached to the diaphragm below; elsewhere it is but loosely connected to the contiguous surfaces.

The pleura is supplied with blood-vessels from the internal mammary, intercostal, phrenic, and other arterial trunks; its veins corresponding in nature to the arteries. Its nervous supply is derived from the phrenic and sympathetic nerves, whilst the absorbent or lymphatic vessels are also numerous.

The diseases to which the pleurae are subject, are chiefly *pleurisy* (which see), or inflammation of the membrane; *pneumothorax*, with or without effusion of fluid into the pleural cavity (*hydrothorax*); and *empyema*. *Hemothorax*, or blood in the pleural cavity, generally results from accidental wounding of the intercostal arteries. Inflammation of the pleura of itself may terminate in *hydrothorax* or *empyema*, the inflammatory products in this, as in other cases, appearing in the form of serous fluid or pus respectively. On the inflamed surfaces of the pleura a deposit of lymph may be formed, which may cause the so-called *friction sounds* of the physician to be heard on listening to the movements of respiration. These sounds are produced by the roughened surfaces rubbing one against another.

PLEURISY, the inflammation of the pleura or investing membrane of the lungs. This disease was for a long time confounded with pneumonia, with which it is often associated. The compound disease is sometimes designated *pleuro-pneumonia*.

Pleurisy may be either acute or chronic. Acute pleurisy is a very common complaint, less so among children and old people than in adults between the time of puberty and old age. It is due to a variety of causes not always easy to trace, but the most common exciting cause is cold acting upon the body while in a state of heat and perspiration. It is also a secondary affection in various diseases, as pneumonia, rheumatism, &c.

It is sometimes preceded by premonitory symptoms, as susceptibility to cold, loss of appetite, &c.; but the announcement of its attack is generally sudden, and is made by an acute pain in the region of the breast. This pain, commonly called a stitch in the side, occurs at each inspiration, and checks the breath of the patient. The pain is most at the lateral margin of the diaphragm, but may occur at any part of the affected side of the chest. It is sharp and lancinating, and often severe. It has been ascribed to various causes. Copland assigns it to the stretching of the inflamed fibrous layer of the membrane during inspiration, Beau to the concomitant inflammation of the intra-costal nerves. A short, dry, suppressed cough frequently attends pleurisy. Sometimes it is attended with expectoration due to catarrh. The combination of the cough with the difficulty of respirations sometimes produces symptoms approaching to asphyxia. The local symptoms may be pre-

ceded or accompanied by fever. While the inflammation continues its progress a sero-albuminous effusion takes place, and when this develops the febrile symptoms subside. When the effusion becomes considerable the affected side is enlarged, and the organs become more and more displaced as the amount of the fluid increases. Double pleurisy is when the disease attacks both sides of the chest at the same time in a primary form. It is rare, but instances of a double attack in a secondary form are more common.

Acute pleurisy is seldom fatal from the mere amount of effusion, unless when it is double, or complicated with other diseases of the lungs or surrounding parts. It is, however, liable to dangerous complications. The acute symptoms generally last only a few days, but the effusion may continue much longer. It is sometimes fatal even without complications, but in a good state of general health it usually ends in recovery. The object of treatment of pleurisy is in the first place to relieve the pain and subdue the inflammation, and in the second to promote the removal of any effusion. In suitable cases the removal of blood by the application of leeches, and subsequent strapping of the chest in order, by the application of pressure, to restrain the effusion, are methods frequently employed. Very often the application of large hot mustard and linseed-meal poultices, and the internal administration of opium in some form, for relief of pain, are all that is necessary. At the same time the patient must of course keep his bed and be carefully nursed.

Chronic pleurisy is either primitive, or the result of acute pleurisy. It may either extend to the whole pleura, or be confined to a more or less circumscribed point of it. Its symptoms are similar to those of acute pleurisy, but of a less degree of intensity. The pain in the side is slight, dull, and fugitive. It is chiefly characterized by effusion, which accumulates in the pleural cavity, and it soon tends to produce lesions, adventitious formations, and other complications in the surrounding organs. Besides local treatment purgatives and diuretics are used in the case of chronic pleurisy. If the disease does not yield to these remedies, the liquid must be evacuated by the operation of *paracentesis thoracis*.

PLEUROBRACHIA, a genus of *Coelenterate* animals belonging to the highest order (*Ctenophora*) of that sub-kingdom. The name *Cydidpe* has been sometimes applied to this genus, the representatives of which exist as free-swimming organisms, possessing clear, transparent, colourless, spheroidal bodies, somewhat resembling a melon in shape, and averaging a marble in size. These beautiful forms may be met with in vast numbers around our coasts in the calm summer seas. At the upper or oral pole of the body the mouth is situated, and around the external surface of the body, disposed in meridional bands running from pole to pole of the organism, eight band-like structures, termed *ctenophores*, are found. These structures, from the presence of which the order *Ctenophora* derives its name, consist each of a band-like surface bearing a number of transverse ridges, each of which bears a fringe of vibratile cilia. The comb-like disposition of the ciliated ridges has thus given origin to the term *Ctenophora* (from Greek *ktenos*, *ctenos*, a comb). The cilia or eyelash-like filaments are longest in the middle of each ridge. Two long flexible tentacles, furnished with cirri or filaments, stretch away from a chamber or sac on each side of the body. These tentacles are capable of being retracted at will within the sac. The mouth opens inferiorly into a stomach, which is continued below into a funnel-shaped cavity, known as the *infundibulum*, and from the latter cavity two

apical canals are given off, one on each side, to open at the apical pole or extremity of the globular body, opposite to the oral or mouth pole. The infundibulum also gives origin to two *paragastric canals*, which form blind or pocket-like sacs on each side of the stomach; and to a pair of *radial canals*, which divide and subdivide as they proceed towards the outer surface of the organism. These radial vessels finally open into the *ctenophoral canals*, which underlie the ctenophores of the outer surface of the body. These canals are lined by cilia, and the entire system of vessels thus partakes of the nature of a circulatory apparatus, by means of which the products of digestion are circulated throughout the body. A structure known as the *ctenocyst* exists as the lower or apical pole, and consists of a clear sac filled with fluid, lined with ciliated epithelial cells, and containing particles of carbonate of lime. It is supposed to be an organ of sense, most probably corresponding in function to an organ of hearing. The generative organs are disposed in band-like masses or in folds, one on each side, below the ctenophoral canals. The entire system of canals corresponds in its homology to the internal division of the body in other Actinozoa, in which class of the Coelenterata the order Ctenophora is contained.

PLEURONECTIDÆ, the family of flat-fishes, represented by the Soles, Flounders, Brill, Turbot, Plaice, &c. As mentioned in the article PLAICE (which see), these fishes are to be regarded as *flat* only in the sense that the *sides* of the body are more compressed than in ordinary fishes. The surfaces which appear flat in the sole and its allies are in reality the *sides*, and not the back and belly of these fishes, as may be seen by noticing that a pectoral fin and the gill-opening exist on each flat surface of the fish; these fins being paired in all fishes, and together with the gill-openings, being situated one on each side. The Pleuronectidæ lie on one side, this side being generally white or colourless; the opposite and upper side of these fishes being dark coloured. Long dorsal and anal fins exist in all. The head and mouth are asymmetrical, and the pectoral fins are generally unequal in size; the ventral fins frequently seeming as if continuations of the anal fin. The body is usually covered with ctenoid scales of small size. The bones of the head are twisted or contorted during the growth of these fishes, so that both eyes are brought to one side of the head—a structure serving to strengthen the idea that this latter *side* represents the back of the Pleuronectidæ. The side to which the eyes are thus twisted round is the uppermost or dark-coloured side, and this side in some (as in the sole) may be the right side of the body, or the left (as in the turbot). The branchiostegal rays number six. The mouth is small, and armed with minute teeth. The abdominal cavity is very limited in size, the organs of the body being contained within a small space under the throat, in which situation the anus or vent opens. The greater part of the body in these fishes is thus made up of a large flat disc-like muscular tail. The swimming-bladder is absent in these fishes, which mostly inhabit the bottom waters, and prefer sandy ground. The food consists chiefly of small crustaceans, molluscs, worms, or even smaller fishes. They swim with the dark-coloured side uppermost, and progress by a kind of undulating motion of the entire body.

The most familiar genus is that of *Pleuronectes*, including the Flounder (*Pleuronectes Asius*), Plaice (*P. platessa*), and Dab (*P. limanda*). The eyes are on the right side in this genus; the body being rhombic in form. The members of the genus *Rhombus*, represented by the Turbot (*R. maximus*) and Brill (*R. vulgaris*), possess the eyes on the left side, and teeth in

the throat as well as the jaws; the dorsal fin commencing in front of the eyes. The Soles (*Soles vulgaris*), included in the genus *Solea*, have the eyes in the right side, and the mouth twisted to the left side. Teeth exist in both jaws, but only in the left side of each; and the body is oval in shape. The Holibut (*Hippoglossus vulgaris*) belongs to another genus of the family. It is a very large fish, and may attain a weight of 500 lbs., and measure above 7 feet in length. In this genus the eyes are placed in the right side, and the dorsal and anal fins begin behind the eyes. The turbot, although also large fishes, do not attain so great dimensions as the holibut. See also ICHTHYOLOGY, PLAICE, SOLE, TURBOT, &c.

PLEURO-PNEUMONIA, a form of pneumonia peculiar to the bovine race. It is highly contagious, and exceedingly fatal, though a certain number of animals recover after a longer or shorter period. It first manifests itself in a morbid condition of the general system; but its seat is in the lungs and the pleura, where it causes an abundant inflammatory exudation of thick plastic matter. The lungs become rapidly filled with this, and the animal suffers from cough and difficulty in breathing. Many die in the course of a few days, while other cases ultimately fatal may last for a number of weeks. The disease is believed to be due invariably to infection, and medical aid seems to be of little or no use. Inoculation with lymph from a diseased animal, however, is believed to be of advantage in warding off an attack, and in some localities it is now very extensively practised. In Britain infected animals and those that have been in contact with them must be slaughtered. See CONTAGIOUS DISEASES (ANIMALS) ACT. For pleuro-pneumonia in the human subject, see PLEURISY.

PLEVNA, the chief town of one of the new districts into which the principality of Bulgaria is divided. It lies a little over 3 miles east of the Vid, a tributary of the Danube, and commands a number of important roads, being hence a place of some strategic importance. It is noted for the gallant resistance of its Turkish garrison under Osman Pasha to the Russians during the Russo-Turkish war of 1877-78. Osman intrenched himself here in the early part of September, and the Russian attempts with superior forces to take the place by storm were failures. When food and ammunition had run short he made a bold effort to cut his way through his enemies, but was compelled to capitulate with 40,000 men (10th Dec. 1877). Pop. (1893), 23,178.

PLEYEL, IGNAZ, a popular modern instrumental composer, born near Vienna in 1757, studied composition under Haydn, and after he had completed his education under the most favourable circumstances, proceeded in 1786 to make a tour through Italy and France, where he was everywhere received with the greatest favour. In 1787 he accepted the appointment of chapel-master to Strasburg cathedral; but had not occupied it long when, in consequence of the revolution, the church service ceased, and the cathedral was shut up. Inclined to the revolution and the freedom anticipated from it, he had endeavoured to gain the friendship of the government by composing a hymn on liberty, but in 1793 was obliged to flee. He proceeded to London; became again connected with Haydn, and gave a series of concerts. He soon after went back to France, and at a later period founded a musical business and piano factory which became one of the most important in Europe. In 1801 he commenced editing the *Bibliothèque Musicale*, in which he inserted the best works of the Italian, German, and French composers. His own works, chiefly instrumental pieces, are light, pleasing, and expressive. The earliest of them are

the best. One of the most popular is the well-known German hymn which bears his name. He died at Paris in 1881.

PLICA POLONICA, a disease peculiar to Poland and the immediately adjacent districts. It is indicated by the matting of the hair, which becomes agglutinated by a nauseous exudation from the roots, the bulbs become enlarged, and the hair swells and becomes soft. Plica is said to have appeared in Poland about the end of the thirteenth century, and is now gradually wearing out. Authorities differ as to the real nature of the disease, and by many it is considered to be due entirely to filth, the exudation from the skin being induced by the constant irritation caused by vermin, though others regard the exudation as eczematous. The disease is usually kept up by neglect, being deemed a safeguard against some internal disease, and no means being taken to remove it. The treatment of plica is for the most part empirical, and beyond cleanliness and attention to diet there appears to be nothing in regard to it determined with certainty.

PLINTH (Greek, *plinthos*, a brick), the lower square member of the base of a column or pedestal. In a wall the term plinth is applied to two or three rows of bricks which project from the face.

PLINY (CAIUS PLINIUS SECUNDUS), author of the *Historia Naturalis*, commonly called *Pliny the Elder*, was born A.D. 23, at Verona, or more probably Novum Comum (Como), to which his family belonged. He came to Rome at an early age, and having means at his disposal availed himself of the best teachers. About the age of twenty-three he served in a military campaign in Germany, under L. Pomponius Secundus, and obtained the command of a troop of cavalry. He appears at this time to have travelled over most of the frontier of Germany. During the intervals of his military duties he composed the treatise *De Jactatione Equestri*, and commenced a History of the Germanic War, which he subsequently completed in twenty books. During the remainder of the reign of Nero he lived in retirement, and composed an educational work, called *Studiosus*, in three books, containing instructions for the training of an orator. He also wrote a grammatical work, entitled *Dubius Sermo*. Towards the close of this reign he was appointed procurator of the emperor in Spain. In 71 his brother-in-law died, leaving him the guardianship of his nephew, the younger Pliny, which he intrusted during his absence in Spain to Virginius Rufus. He returned to Rome before A.D. 73, and then adopted his nephew. He was admitted among the number of the intimate friends of Vespasian. His nephew has left an account of his life at this period, which was one of constant study. He made extracts from all the books he read, or had read to him, and at his death left his nephew 160 volumes of these notes. His *Natural History*, which he compiled from materials accumulated in this way, was published about 77. He perished in the eruption of Mount Vesuvius which overwhelmed Pompeii and Herculaneum in 79. The only work of Pliny which is now extant is his *Natural History*. It is divided into thirty-seven books, and is, according to his own account, a compilation from upwards of 2000 volumes. It embraces the domain of natural history in the widest sense, including astronomy, geography, and meteorology. It even goes beyond what natural history in any sense would include—treating of the fine arts, and human institutions and inventions. The first edition of Pliny's *Natural History* was published at Venice in 1469. The edition of Hardouin (Paris, 1685, five vols. 4to) is the first critical edition. The edition of Panokouke (Paris, 1829-33), with a French translation, and notes by eminent modern

naturalists and scientific men, including Cuvier, is of great value. The best editions of the text are those of Sillig (Leipzig, 1881-86, five vols. 12mo), and Jan and Mayhoff (Leipzig, 1870 onwards). Pliny was translated into English by Dr. Philemon Holland (London, 1601, two vols. folio). There is a translation in Bohn's Classical Library by Dr. Bosworth and T. H. Riley. There are numerous translations into foreign languages.

PLINY (CAIUS PLINIUS CAECILIUS SECUNDUS), the Younger, a nephew of the former, was born A.D. 61 or 62, probably at Comum (Como). Having lost his father at an early age, he was adopted by his uncle, and was carefully educated. He applied himself early with the greatest assiduity to the study of eloquence and philosophy, and when a boy of thirteen years of age made an attempt to write a tragedy in the Greek language. In Syria, where he was the commander of a legion, he enjoyed the society of the philosopher Euphrates, and afterwards made his appearance in Rome as an advocate with success, filled several public offices, and was consul in A.D. 100. In A.D. 108 he was appointed propretor or governor of the province of Pontica, which office he administered for almost two years to the general satisfaction. He was one of the most distinguished and best, and, we may also add, one of the most fortunate men of his age. He had most of the requisites for the enjoyment of life—he was rich, he possessed a cultivated mind and a generous heart, and was fortunate in his friends. The time of his death is unknown. He was twice married, but had no children. As an author he laboured with ardour. He attempted several departments of literature, both in prose and poetry. Of his writings only a collection of letters in ten books, and a panegyric on Trajan, remain. The letters are addressed to different friends, some of them to the emperor, and are on various subjects. They appear to have been collected by the author himself, and were probably written with a view to publication. The most valuable among them is the celebrated correspondence between Pliny and Trajan, containing the letters regarding the persecution of the Christians in his province which have drawn forth so much comment. The sentence of death seems to have been passed upon any one admitting himself a Christian, though nothing more could be brought out in evidence against them than that they were in the habit of meeting on a fixed day before it was light and singing a hymn to Christ as God; they also, Pliny says, took an oath to avoid theft, robbery, adultery, breach of faith, and denial of a deposit. Pliny examined by the torture (as was the Roman custom) two of his female slaves who were Christians, but could not discover that the Christian religion was anything worse than 'a perverse and extravagant superstition.' As the superstition was spreading, Pliny asked the emperor's advice as to how it should be dealt with. The emperor's directions were that persons supposed to be Christians were not to be sought for; if they were accused, and the charge proved, they were to be punished; but if they denied the charge, and offered up their prayers to the heathen gods, they were to be let alone; charges not bearing the name of the informant were not to be received, as they had been. It must be remarked that all meetings at irregular times and places, and especially nocturnal meetings, were odious in Roman eyes, and enough of themselves to subject the participants in them to the interference of the authorities. But it is not clear that the Christians would as yet have been allowed to assemble openly. His Panegyric on Trajan is a mere eulogium, containing little information, and fulsomely expressed. The Letters and the Panegyric were edited, together with

notes, by Gesner (Leipzig, 1739), Ernesti (Leipzig, 1770), and others. A critical edition of the Letters, with notes, was edited by Gierig (Leipzig, 1800), and the complete works of Pliny by the same (Leipzig, 1806); afterwards by G. H. Schäfer (Leipzig, 1815); and by Titze (at Prague, in 1820). The best modern edition of Pliny's *Epistles* is that of H. Keil (in the Teubner series). The *Epistles* of Pliny have been translated into English by Mr. Melmoth (ed. by Bosanquet, 1878). Church and Brodribb's volume of *Select Letters* (with notes) is valuable.

PLIOSAURUS. See **PLESIOSAURUS**.

PLOCK, or **PLOTZK**, a town in Russian Poland, right bank of the Vistula, 60 miles north-west of Warsaw, on a height. It has no less than twenty-five squares, of which one in the old town is very regularly built. It has a handsome cathedral; and a considerable trade; and several large fairs. Pop. 27,372.—The government of Plock has an area of 4200 square miles of a level and moderately fertile territory, with a pop. (1897), of 556,877.

PLOESTI, or **PLIOESTI**, a town of Roumania, capital of the circle of Prahova, a place of considerable trade, and also a centre of petroleum refining from naphtha obtained in the neighbourhood. Pop. 33,000.

PLOTINUS (*Plotinos*), the systematic founder of Neo-Platonism, was born about 203 or 204 A.D., according to Suidas at Lycopolis, in Egypt. In his intercourse with his pupils and acquaintances he avoided all reference to the antecedent circumstances of his life, his age, nativity, or parentage; and Porphyry, his biographer and most intimate friend, could tell nothing on these matters from his own communications. He held, in fact, an opinion approaching to contempt for all the circumstances of bodily existence, was afraid of his birth-day being held in honour, and but for a stratagem of Amelius, who introduced a portrait-painter to his lectures to paint him from memory, would have defeated the wish of his friends to preserve his likeness to posterity. It is conjectured that he was of Roman descent, probably a freed-man. Until his eighth year, before which period he had been sent to school, he was fed from the breast. It was in his twenty-eighth year that the desire to study philosophy awoke in him. His first teacher Alexandriens gave him no satisfaction. He then fell into great despondency, and was brought by a friend to Ammonius Saccas, a philosopher who was brought up a Christian, and has written some works on Christian theology, but who, according to Porphyry (controverted by Eusebius and Jerome), returned to the Hellenic faith. He remained with him till his thirty-ninth year. In 242 he joined the expedition of the Emperor Gordian to the East, in order to learn the philosophy of the Persians and Indians. After the death of Gordian he reached Antioch with great difficulty, and arrived at Rome in his fortieth year. It was here he subsequently lived and taught. The leading pupils of Ammonius, besides Plotinus, were Origen (the Neo-Platonist), Herennius, and Longinus. Ammonius taught verbally, and Plotinus had entered into an agreement with Origen and Herennius not to commit his doctrines to writing. This agreement was first broken by Herennius, when Origen considered himself relieved from it. Plotinus continued still to observe it for some time. His lectures at this time are described by Amelius as distinguished by want of order and superfluity of words. About 254 his friends induced him to put his doctrines in writing. From this time till he was joined by Porphyry (about 262–264) he composed twenty-one books, which were only put into the hands of the initiated. During Porphyry's stay in Rome he composed twenty-four, and

after Porphyry had left for Sicily (267–268) other nine. On account of the weakness of his sight Plotinus left the correction of his works to Porphyry. He was wholly indifferent to style, and exclusively occupied with the matter of his teaching; but he was accustomed to think out his ideas so thoroughly before committing them to writing that they required only literary correction. Porphyry was his literary executor, and has arranged his works in six *Enneads*. Porphyry considered those written during his own stay at Rome the most valuable, but he has not observed a chronological order in their arrangement. The works of Plotinus were highly valued by Longinus, although that philosopher was in no sense a Plotinist. Plotinus's discourse, as well as his writing, was marked by energy and enthusiasm. He was in fact a preacher. His fervour is said to have increased the beauty of his countenance. His teaching secured him great respect and popularity among those who did not receive Christianity. Parents left their children to his care, and his house was full of orphans of both sexes intrusted to his guardianship. Although neglectful in his own person of temporal interests, he showed no want of practical shrewdness in looking after the estates of his wards. Plotinus enjoyed the favour of the Emperor Gallienus, from whom he obtained the rebuilding of two destroyed towns in the Campania, with a view to their being governed according to the laws of Plato. Various dates from 262 to 270 are given for the death of Plotinus. He was afflicted with disease of the bowels, for which he used no remedy but rubbing; and his assistants having died of the plague, the leaving off of this application induced a relaxation of the throat, which deprived him of speech. He retired to the country house in the Campania of a deceased friend named Zethus, where he died.

Plotinus was one of the great masters of philosophy. The value of his system depends less upon the intrinsic truth it contains than upon its historical importance, and its adaptation to a certain class of human sympathies. The historical value of the system, which is great both in its antecedents and consequents, is due partly to the circumstances out of which it arose, and partly to the genius and originality of its founder. It had its source at the junction of two independent streams of thought, which, already fortuitously united, received a new direction from the individual energy of the mind of Plotinus. It is uncertain how much he owed to his immediate teacher Ammonius; but as Longinus, who was a constant hearer of Ammonius and of Origen, steadfastly rejected the doctrines of Plotinus, it is probable that the latter treated Ammonius, as he certainly treated Plato, according to his own individuality. Plotinus was well acquainted with the older Greek philosophy, with the Ionian and the Eleatic schools, with Plato and Aristotle and other founders of systems, and according to the eclectic tendencies of his day he believed there was a fundamental unity in these various systems. Ammonius, in particular, held the substantial agreement of Plato and Aristotle. It was to Plato, however, that Plotinus looked as his great authority. He believed himself a strict follower of Plato, and his own system a legitimate development of the principles of that great philosopher; but if the system of Plotinus is in any respect the descendant of the philosophy of Plato, it is to the defects of that philosophy alone that it owes its existence. Plotinus uses Plato's term, the Good, for his highest generalization; but he uses it in a wholly different, and even opposite, sense from Plato. The Good with Plato was a synthesis of all that is highest and most excellent in intelligence; with Plotinus it is an abstraction from which every determinate quality is removed; and

there is a corresponding difference in the ethical developments of their systems. With Plato the highest attainment of human morality is the imitation of God through the ideas discoverable by human reason, which he has placed in created things; Plotinus despises all imitation, as well as the things themselves which are proposed to it, and finds the practical aim of his philosophy in the direct union of the human spirit with the deity. It is from a different, though unacknowledged, source that the operative principle of the philosophy of Plotinus is derived. The emanation theory of eastern philosophy, which was first formally combined with Greek philosophy by Philo, had since his time formed an element in various eclectic systems, which had distinctively formed an Alexandrian school; but Philo and his successors did their work like compilers, and it needed a mind of creative energy to weld the elements thus brought together into one. This was accomplished by Plotinus. Another influence, likewise unacknowledged, affected the development of the last great system of pagan philosophy, the growth of Christianity. Plotinus was not, like Porphyry, a violent and open enemy of Christianity. With regard to it, as to oriental philosophy and theology generally, he maintained silence. Even in encountering the Gnostics he opposed their heretical principles without touching those they held in common with orthodox Christians. All Plotinus's treatises are occasional; they are full of repetitions, and his doctrines are not developed in them with any order or method, while the difficulty of understanding them is enhanced by the incomprehensible nature of the doctrine itself.

The highest generalization of Plotinus, which he calls the Good, is a pure undetermined abstraction. It can be described neither as being nor not being, moved nor resting, free nor necessary. Out of this indetermination springs a trinity which is the source of all subsequent being. The original unity, by the excess of its energy, sends forth an image of itself, as the sun emits rays. This image, which is the beginning of plurality and the source of all determinations, also exists absolutely, and is the immediate productive power of the indeterminate unity. Turning with an involuntary movement towards its original in order to behold it, it generates spirit, which is the source of intelligence or thought. Every act of thought directed to the unconditioned produces a real existence, an idea; all these ideas differ in form, but are one in substance. The soul is developed out of the spirit as the idea contained in it; being the immediate product of the spirit, it has a share in all ideas, of which it is itself one. It has, in contradistinction to the spirit, the power of looking out from itself, and thus in imaging the world unites the sensuous with the intelligent. The sensuous is the image of the soul, as the soul is of the spirit. Matter is the lowest boundary of being, the necessary contrast of the good, and in so far negative and evil; but in its susceptibility of form it partakes of the positive and the good.

This hierarchy of being has the beauty of completeness, but it is entirely without evidence, save in the imagination of its author. It differs from Plato in making something anterior to intelligence, and consequently in deriving intelligence from non-intelligence; and in giving soul the power which it denies to spirit, of looking out from itself, it makes the product superior to the producer. Yet this extraordinary system is the result of a severe system of dialectic. Plotinus believed that he followed Plato in making error and imperfection consist in multiplicity and division, and truth in simplicity and unity. Consequently the higher he could go in generalization, the nearer he approached to the source of truth, the

primary form of being. Now he found that the conception of being itself was complex, and above that conception stood the conception of unity; but even to name unity was to dissolve it, hence his highest generalization was the unnamable. But the aim of Plotinus was not merely to know but to reach this undefined source of being, of which even being itself could not be predicated. To pursue truth upward to the end would necessarily lead the human mind to its source, but a source above intelligence could not be reached by intelligence; hence new methods had to be invented. Plotinus applied his dialectic to the mind and to the nature of its relation to truth, and in contradiction to the common position of psychology, that the mind can only know itself in some determinate state, he discovered that the human spirit can know itself absolutely, and to the negation of all objects of consciousness. Thinking or meditation, which is the mere act of intelligence, he held to be incompetent to reach unconditioned being, which is grasped only by intuition. Truth accordingly, he held, stands in no need of demonstration. It is comprehended immediately when the spirit sees only itself. In this pure state, to which he gave the name of ecstasy, the Absolute Being gazes upon itself through the medium of our spirits. Porphyry records that Plotinus had succeeded in raising himself to this state four times, while he himself had done so only once. Proclus goes a step further than Plotinus, and announces that the man who raises himself to this condition is God. Thus the final conclusion of a system founded upon the subtlest use of dialectic is to set aside dialectic as unnecessary and useless. The system of Plotinus might be briefly characterized as the suicide of reason, if that description were not of generic rather than specific application in philosophy.

In virtue of this super-rational method the Neo-Platonic philosophy became by eminence the system of mysticism. In default of reason it appealed to imagination, to the love of the unknown and mysterious, and to the ambition so dear to the heart of man. Urged by this new principle of vitality, it sent its shoots across the gulf which separated the rising power of Christianity from the declining cause of paganism, and planted itself vigorously on the other side. But the penalty of evoking vulgar sympathies by this unphilosophic method could not remain unpaid. With mysticism came superstition, the belief in magic, and ignorant theurgical pretensions. Plotinus himself encouraged such beliefs, which allied themselves by a too natural transition with his principles.

The mysticism of Plotinus has a remarkable analogy with the leading doctrines of Christianity as these are developed in the Gospels and epistles of St. Paul and St. John; and as Neo-Platonic mysticism came into combination in subsequent mixed systems with Christianity, it is important to note their points of divergence at their source. Christianity affirms that man cannot by his own efforts attain to direct communion with God, but that God can be known indirectly by his works. Neo-Platonism reverses both the affirmation and the negation. Again, while Neo-Platonism and Christianity both affirm the possibility of a direct communion between God and man, Neo-Platonism establishes this communion through the power inherent in man to rise by abstraction to God; Christianity recognizes its possibility only through the condescension of God in coming down to man, a condescension which is wholly independent of human efforts, and to meet which moral purification is the only possible or fitting preparation on the part of man.

The first complete edition of the *Enneads* of Plotinus

tinus was the Latin translation of Marcellus Ficinus (Florence, 1492), with a faulty Greek text appended. There is an Oxford edition by Fr. Kreuser, published in 1835; a Paris one by Kreuser and Moser (1855, with Latin translation); and later ones by H. F. Müller (1878-80) and Volkmann (1883-84). There are translations of selections of the works of Plotinus by Thomas Taylor.

PLOUGH. See AGRICULTURE.

PLOUGH-LAND is an equivalent expression with a hide or hyde of land, and is also known as a *carucate*. In Scotland the possession of a ploughgate of land is the legal qualification for hunting. The ploughgate has been defined as equivalent to 96 acres, but the quantity appears to differ in different charters.

PLOUGH MONDAY, the next Monday after Twelfth Day. On Plough Monday the ploughmen in the northern part of England used to draw a plough from door to door, and beg money for drink.

POLOVER, a general name of Gallatorial or Wading Birds of the family Charadriidæ, but applied more especially to species of the genus *Charadrius*. The bill is as long as the head, or may be somewhat shorter; it is usually straight, the base being slender, and the tip more or less strongly arched and pointed. The nostrils open at the base and are situated in a groove or depression extending along one-half of the bill's length. The legs are long and slender, the lower portion of the shin being destitute of feathers. The tarsi are covered with hexagonal scales. The two outer toes are joined by a web at their base; the hinder toe being either wanting or of very rudimentary nature. The gizzard is large and powerful, and the intestinal cæca are elongated. These birds are gregarious in habits, and often frequent marshy spots; but appear to seek the sea-coasts in winter. The eggs are deposited in a hole in sand or gravel, the nest being thus of very imperfect construction; the young being able to run about as soon as they are hatched. The flesh and eggs of the plovers are considered as great delicacies. The sub-family Charadriinæ is constituted for the reception of the True Plovers, together with the Lapwing (which see) or Green Plover. These birds occur chiefly in America and in Europe, several species being peculiar to the former continent. The Golden Plover (*Charadrius plumialis*) is distributed throughout Europe, and is the most familiar species in Britain, where it breeds on elevated grounds or in barren localities, retiring to more southern countries in winter. Its plumage is blackish, plentifully sprinkled with golden-yellow on the upper parts. The *C. helveticus* (or *Squatarola helvetica*), the Gray Plover of Northern Europe and America, is also a familiar species. The British Ringed Plover (*C. hiaticula*) is also a well-known member of this group, as is also the Dotterel. The Ringed Plovers are sometimes regarded as forming a separate genus *Egialitis*. The Stilt Plovers or Stilts (*Himantopus*), so named from their very long, slender legs, are often included in another sub-family of the Charadriidæ. The plovers have the habit of patting the ground with their feet in order to attract worms to the surface, and so to obtain them for prey. The name 'plover', French *pluvier*, is derived from *L. pluvia*, rain, in allusion, it is said, to the greater wildness of these birds in rainy weather. The well-known 'plover's eggs' of the shops are chiefly lapwing's, many of them brought from the Continent.

PLUM, the name of a well-known fruit and of the tree which produces it. All kinds of plum-trees belong to the order Rosaceæ and the genus *Prunus*, of which they form a section characterized by having leaves convolute in bud; flowers pedicellate, solitary

or in pairs, preceding or appearing at the same time as the leaves; and the fruit a glabrous and often glaucous drupe, with smooth or wrinkled stone. The peach, apricot, almond, and cherry are often put in the same genus. The well-marked varieties of fruit comprised under the term plum (damson, bullace, green gage, &c.) are by some all regarded as ultimately descended from the wild blackthorn or sloe (*P. spinosa* or *communis*—see SLOE), but others distinguish two species, namely *P. domestica*, including the plums proper, and *P. insititia*, represented especially by the bullace. The original home of the plum proper was probably Central Asia, and many of the varieties in cultivation in Britain have come by way of France. In colour the fruit may be white, green, yellow, purple, &c., and it may vary in size, shape, taste, and consistence of flesh, but the skin is always smooth. The European plums have long been cultivated in the United States, where some of them have been crossed with native species. Plum-trees require a well-drained subsoil and a good loamy soil. As the roots remain near the surface, the soil need not be very deep. The more tender kinds should be grown against a wall, but ordinary varieties are usually planted as standards or bushes in the open. Fan-training is the best system for the wall kinds. Some varieties, especially those intended for stocks, are propagated from seeds, and others occasionally from suckers; but the usual mode of propagation is by budding and grafting. The insect and other enemies of the plums are various. The best varieties of desert plums and gages include: Angelina Burdett, Coe's Golden Drop (a gage), Denniston's Superb (a gage), Green Gage (Reine Claude), Reine Claude Violette (Purple Gage), and Washington (American). The bullaces are distinguished from damsons by their white colour and more spherical shape, as well as by their harsher taste. Both grow wild abundantly in various parts of England. Almost all varieties of plums may be dried and converted into *prunes*, though some suit this purpose much better than others. In recent times Japanese plums have been much cultivated in the United States, and some of them are being introduced into Britain. They are recommended chiefly by great adaptability, comparative freedom from diseases and insect enemies, and the good keeping qualities of the fruit. See The Gardener's Assistant (1901) by Thompson and Watson.

PLUMBAGO, or GRAPHITE, names applied to several varieties of native carbon containing from about 50 to nearly 100 per cent of that element. Plumbago has an iron-black or steel-gray colour, a metallic lustre, and produces a black, shining streak on paper. The specific gravity of this mineral is 1·8; it is a remarkably good conductor of electricity. There are two leading varieties of graphite: (1) *Crystallized* or *foliated*, which is found in small six-sided tables in Ceylon, Australia, New York State, &c. This variety is produced in the cooling of molten iron, when part of the carbon rises to the surface in crystalline forms. (2) *Amorphous*, which is without crystalline structure, and is softer than the crystalline variety. It leaves a much blacker streak on paper. It is largely used, under the name of *black lead*, for making pencils. Borrowdale in Cumberland formerly produced much graphite. The chief sources of this mineral are now Ceylon, Ticonderoga (New York), Siberia, Bavaria, Bohemia, &c.

PLURALITY, in ecclesiastical law, signifies the holding by the same person of two or more benefices. Pluralities were forbidden by the canon law, but the bishops and the pope assumed the right of granting dispensations to hold them. They were prohibited by the Councils of Chalcedon (451), Nicea (787),

and Lateran (1215). In England they were prohibited by act 21 Henry VIII. cap. xiii. and 57 George III. cap. xcix. The Pluralities Acts of 1838, 1850, and 1855 determine definitely the conditions under which two benefices may be held by one person at the same time. Under the last act two benefices can be held simultaneously by one person provided the churches are within 4 miles of each other by the nearest road, and the income of one of them does not exceed £200 per annum. A licence or dispensation from the Archbishop of Canterbury is necessary, however. In Scotland it is illegal for a minister to hold two pastoral charges together.

PLUS (more), in mathematics, signifies addition; the sign by which it is indicated is +; thus A + B, which is read A plus B, denotes that the quantity A is to be added to the quantity B. Plus, or its sign +, is also used to indicate a positive magnitude or relation, in opposition to minus -, which indicates a negative.

PLUSH, a species of cloth of a description similar to velvet, from which it differs only in the length of the nap, which in velvet is cut short, while in plush it is made long, flat, and glossy. Plushes are made in as great variety as velvets, both in texture and material. Cotton, wool, silk, goats' hair, swans' down, &c., are used in their fabrication. The nap may be formed either in the warp or woof, the one in which it is being double, there being a warp and a woof for the body of the cloth, and a warp or a woof for the nap. Plush for hats is largely manufactured in France; it is formed of a warp of unbleached silk with a cotton woof and a nap of dressed silk. France supplies nearly the whole of Europe with this fabric. The manufacture of silk-plush for hats was first introduced in Rhenish Prussia, but the improvements of a Lyons manufacturer, J. B. Martin, whose first patent was dated in 1833, revolutionized the trade and transferred its seat to France. The inventor himself extended the manufacture by the founding of new establishments to the departments of Rhone, Loire, Isere, Meurthe, and Moselle (Metz). The house of J. B. Martin has thrice received the decoration of the Legion of Honour—in 1855, 1867, and 1874, the last time on the occasion of the Vienna Exhibition.

PLUTARCH (*Ploutarchos*), a learned and prolific Greek writer, born at Cheronæa in Boeotia. He studied philosophy under Ammonius, a peripatetic philosopher of Attica, in A.D. 66, which is the only indication of his age. He appears from his writings to have visited Italy, lectured there on philosophy, and stayed some time at Rome, where he lectured during the reign of Domitian. He is said on doubtful authority to have been the preceptor of Trajan. He spent his later years at Cheronæa, where he had a priesthood and a magisterial office. The time of his death is unknown. His *Parallel Lives of illustrious Greeks and Romans* is the work to which he owes his fame. The lives are written in pairs, one Greek and one Roman, followed by a comparison of the two, which in some instances is wanting, and a few of the Lives themselves are lost. In these Lives Plutarch is said to have quoted 250 authors, the works of many of whom are lost. His Lives are chiefly intended for the illustration of character, and as he makes use of incidents for this purpose without regard to their relative value, his Lives are only partially serviceable for historical purposes. In the arrangement of his incidents he does not always follow a chronological order. Their excellence consists mainly in their fidelity in biographical portraiture. A Latin collection, consisting of translations made by different persons of the separate lives, was printed in Rome in two vols. folio in 1470. The first edition of the

text was printed in Florence in 1517. An edition by Bryan, with a Latin translation (completed after his death by Du Soul), was published in five vols. 4to in 1729. There are editions by Coraes (1809-15), Sintenis (1839-46, four vols. 8vo), and Dübner (1846-47). Among translations there is the fine old French translation by Amyot (1559), and there is of this the worthy English version by Sir Thomas North (London, 1579), characterized as 'Shakspeare's storehouse of learned history'; as also one by Evelyn, Garth, Creech, &c., with a life by Dryden (five vols. London, 1683-86); and one by John and William Langhorne (six vols., London, 1770, with several subsequent improved editions). The translation called Dryden's was corrected and revised by A. H. Clough, and published in 1859, in five volumes. George Long has translated and annotated some of the Lives. Plutarch's other works are about sixty in number; they are generally classed as *Moralia*, though some of them are narrative. Philemon Holland executed an English translation of the *Moralia* (1603), and there is also a modern translation by several scholars published in America (Boston, 1874-78). An edition of all the works of Plutarch, by J. C. Hutten, appeared at Tübingen (1791-1805) in fourteen vols. 8vo. There is also a Paris edition with Latin translation (Didot, 1862-77). The best text of the *Moralia* is that of Bernardakis (seven vols. 1888-97). The name Plutarch is sometimes given to a collection of lives of distinguished men.

PLUTO, in Greek mythology the giver of wealth, or HADES, the god of the lower world. The former name gradually superseded the latter, which was more commonly used by the poets. He was the third son of Cronus and Rhea, a brother of Zeus (Jupiter) and Poseidon (Neptune), and to him, on the partition of the world, fell the kingdom of the shades. He married Persephone, the daughter of Demeter. Sacrifices of black sheep, male and female, were offered to these deities. Under the surface of the earth he is enthroned as the ruler of the dead. As far beneath his habitation as the heaven is above the earth, lies Tartarus, the access to which is by a gate guarded by himself; thither, after death, must all men descend. Powerful, terrible, inflexible to prayers or flattery, is the dark-haired god. Heracles, however, carried off his dog, the fearful Cerberus, who lies before Pluto's dreadful abode. He rides on a chariot drawn by four black horses, which he guides with reins of gold. His helmet makes the wearer invisible. So says the *Iliad*. The *Odyssey* gives a somewhat different account. It does not explicitly place his habitation beneath the earth. Ulysses sailed from *Æeæ* with a north wind, passed over the ocean, and landed near the lofty rocks and the grove of Persephone, where the Cimmerians dwell in everlasting night. Having arrived there he proceeded along the ocean until he reached the nocturnal darkness, the abode of *Aïs* (Hades), where dwell the dead. But according to Hesiod, on the western margin of the northern hemisphere, wrapped in eternal darkness, one cleft in a cavity under the surface of the earth leads down to the dead, another to Tartarus. Yet both of these subterranean abysses are mentioned by him under the latter name. Homer, and those poets who followed next after him, described the realms of Hades as being under the surface of the earth, where the dead, like the living on earth, good and bad, dwell together, and a few enemies of the gods alone suffer torments; Tartarus was a distinct region. But as philosophy, by bolder conjectures concerning the surface of the earth, and finally by the doctrine of a floating sphere, did away the old notions of Tartarus, and as the belief of a future retribution gained ground, the realms of the dead, placed at first under the surface of the

earth, and then by some in the centre, were separated into Elysium and Tartarus. These changes had also an influence on the notions entertained respecting the sovereign of the lower world. He not only gained in outward power and supremacy, but the conceptions of his character were changed; he became a benevolent being, who held in his hand the keys of the earth, and blessed the year with fruits; for from the abyss of night come all riches and plenty. It is therefore not strange that the later ages, confounding Hades with Plutus, called him Pluto, and attributed to him dominion over the treasures concealed in the bowels of the earth. He fought with his brothers against the Titans, and received from the Cyclopes, whom he had released, the helmet that makes its wearer invisible, which he lent to Hermes in the war of the giants, and to Perseus in his expedition against the Gorgons, and which afterwards came into the possession of Meriones. The Furies, who are said to be his daughters, and Charon are his ministers. He judges every open and secret deed, and to him are subordinate the three judges Æacus, Minos, and Rhadamanthus. Bacchus, Heracles, Orpheus, and Ulysses entered his realms alive, and left them uninjured; but Theseus and Pirithous, whose object is said to have been the abduction of his wife, he caused to be chained, though the former is said to have been subsequently released by Heracles. The worship of Pluto was extensively spread among the Greeks and Romans. The cypress, the box, the narcissus, and the plant adiantum (maiden-hair) were sacred to him: oxen and goats were sacrificed to him in the shades of night, and his priests were crowned with cypress. He is represented in gloomy majesty, his forehead shaded by his hair, and with a thick beard. His head is sometimes covered with a veil. He frequently also wears his helmet, or a crown of ebony, or a wreath of adiantum or narcissus. In his hand he holds a two-forked sceptre, a staff or a key; by his side is Cerberus. He is either seated on a throne of ebony or in a chariot.

PLUTUS, son of Iasion and Demeter, was the god of riches. His genealogy shows the meaning of the allegory, which is merely this, that 'Agriculture produces wealth.' At first Plutus had the use of his eyes, but Zeus struck him blind because he confined his gifts to the good; and he thenceforth conferred them equally on the good and the bad. His residence was under the earth. He is weak and limps when he comes to mortals, but swift-footed or winged when he leaves them. Fortune carries him in her arms, and he also forms one of Athena's retinue. He is sometimes confounded with Pluto.

PLUVIOSE, one of the months of the French Republican calendar. See CALENDAR.

PLYMOUTH, a seaport town, municipal, parl., and county borough of England, in the county of Devon, on the Sound of same name, between the estuaries of the Plym and Tamar, 36 miles south-west of Exeter, 44 by road and 53 by rail. Taken in its largest sense, it comprehends what are called the 'Three Towns,' or Devonport on the west, Stonehouse in the middle, and Plymouth proper on the east. Devonport has on the west the Hamoaze or lower part of the Tamar estuary, and is divided from Stonehouse and Plymouth proper by an inlet crossed by several bridges. As it forms with Stonehouse a parliamentary borough distinct from Plymouth it is described under its own name, and the present article refers only to Plymouth. Taken in this restricted sense, Plymouth is bounded by the Sound and Catwater on the south (the Catwater being the estuary of the river Plym), and extends from Stonehouse on the west to the Plym or Catwater on the east. The

site is uneven, and somewhat rugged, consisting of a central hollow and two considerable eminences, one on the north, and the other, called the Hoe, on the south, laid out as a promenade and recreation ground, from which a magnificent view is obtained. On the Hoe has been re-erected the old Eddystone lighthouse (Smeaton's), and there are also here a statue of Sir Francis Drake, and a memorial of the Armada. At the east end of the Hoe, on a bold headland, stands the citadel erected in the time of Charles II. The older parts of the town consist of narrow and irregular streets, devoid of architectural beauty, and often steep and winding. But in the newer parts and suburbs many handsome terraces and villas have been erected. The public buildings include the two parish churches—St. Andrew's church, a fine Gothic building of the fifteenth century containing some fine monuments, and Charles' church, of the seventeenth century, with an elegant spire; Sherwell Congregational chapel, and the Roman Catholic cathedral; the guildhall, opened in 1874, a handsome Gothic building; the Royal Hotel and theatre, an elegant pile of buildings in the Grecian style; the post-office, on the model of a temple of Vesta at Tivoli in Italy; the custom-house, a large and handsome granite structure; the exchange, the atheneum, the mechanics' institute, the Plymouth and Cottonian public library, containing 10,000 volumes, and a collection of original drawings, prints, paintings, and artistic articles, the Grammar and other endowed schools, the Public Dispensary, Female Penitentiary, Eye Infirmary, South Devon and East Cornwall Hospital, &c. The laboratory and head-quarters of the Marine Biological Association are located here.

The manufactures include soap, sail-cloth, brushes, Roman cement, earthenware, rope and twine, &c., and there are also ship-building yards, foundries, two sugar-refineries, breweries, starch-works, and flax, saw, and flour mills, together with limestone quarries. The fisheries, chiefly of whiting, hake, and mackerel, are very productive. The trade also, both coasting and foreign, is very important, the coasting trade in particular being remarkably extensive. Steamers ply regularly to North America, the Cape, Australia, New Zealand, the West Indies, &c. The parts of the port chiefly appropriated for mercantile shipping are Sutton Pool and Mill Bay, particularly the latter, where there are extensive wet-docks, and the largest vessels lie in safety along its fine pier and pontoon even at low water. The number of vessels that entered the port in 1900 was 2903 of 884,918 tons burden; and the number cleared 2902 of 883,222 tons. Plymouth owes its celebrity chiefly to its importance as a great royal naval station, for which the spaciousness of its Sound, and the depth of water retained by its arms after penetrating far into the mainland, render it admirably suited. Originally, however, the Sound, about 3 miles wide at its mouth, being open to the south-west winds, left vessels at anchor exposed to the greatest danger. With the view of protecting the anchorage from the heavy swell of the sea, the stupendous national work, known by the name of the Plymouth Breakwater, was undertaken, and was finally completed at an expense of about £2,000,000. It consists of a central body of 1000 yards, and an arm or cant at each extremity, of 350 yards, making the whole length only 60 yards short of a mile. The height is from 56 to 80 feet, the top 45 feet broad, and from 2 feet to 3 feet above the high-water of spring-tides. On the west end of the breakwater a lighthouse, 68 feet above the platform, and visible at the distance of 8 miles, except in foggy weather, has been erected, but the entrance into the Sound is guided by the still more celebrated Eddystone lighthouse, which stands on a large cluster

of rocks in the channel opposite to it. To defend the port an iron-cased fort was built near the breakwater, and St. Nicholas, or Drake's Island, within the breakwater, has been furnished with strong fortifications, mounted with heavy guns. Various other forts and batteries also defend the place. The chief naval establishments are in Devonport and Stonehouse, the former having the royal dock-yard for building and repairing ships, the steam-yard for machinery and boilers, &c.; while Stonehouse has the victualling yard, naval hospital, marine barracks, &c. The Hamoaze is a favourite anchorage for men-of-war.

Plymouth, originally a fishing village, bore in very early times the name of Tamarworth, which, after the Conquest, was changed to that of Sutton, or South Town. It had become a considerable town under its present name in 1438, when a charter, confirming its old and granting many new privileges, was conferred upon it by Henry VI. From Elizabeth it obtained a new charter through the solicitation of Sir Francis Drake, of whom a handsome statue was erected on the Hoe in 1884; and on the threatened invasion of the Armada equipped as its quota to the British fleet, which had here its rendezvous, seven ships and a fly-boat, a greater number than was furnished by any port except London. George III. with his queen visited it in 1789, and Bonaparte arrived here in the *Bellerophon* in 1815. Plymouth is governed by a mayor, fourteen aldermen, and forty-two councillors, and sends two members to the House of Commons. Pop. in 1891, co. bor. 84,179, parl. bor. 87,480; in 1901, 107,509 and 105,404.

PLYMOUTH, a town of the United States, capital of Plymouth county, Massachusetts, the oldest town in New England. It was settled by the pilgrims who arrived in the *Mayflower*, December, 1620, and stands on a fine harbour 36 miles S.E. of Boston. The principal buildings are the court-house, jail, and churches. The bay is spacious, but shallow, and the harbour secure, though difficult of access. The town has manufactures of woollens, cottons, boots and shoes, &c. There is a national monument to the pilgrims, and a hall called Pilgrim Hall, in front of which is a portion of the rock on which the pilgrims landed. Pop. (1890), 7314.

PLYMOUTH BRETHREN, a sect or association of Christians which arose in England about 1830, and took its popular designation from the town of Plymouth, in which it first began to flourish. The rise of this body appears to have been partly spontaneous, partly due to the labours of John Darby, first a barrister, then a clergyman of the Church of England, and subsequently a Dissenter, the coincidence of whose views with that of some sectaries of Plymouth supplied the denominational basis, from which the sect spread itself with considerable rapidity, gaining numerous adherents in England, on the Continent of Europe, particularly in Switzerland, France, and Italy, and in the United States of America. Darby separated from the Church of England specially on the ground of scruples in regard to apostolical succession. To theological views strongly tinged with mysticism he united communistic views of church organization, which, however, were arrived at as the result of a peculiar process of reasoning rather than adopted for their own sake. He appears to have held that apostolical succession was the true foundation of church organization, but that it was actually lost. The church therefore as a corporation had, like the Israelites as a nation, been rejected of God on account of its declension from the truth. There remained only the voluntary association of Christians among themselves, and in their meetings the Plymouthists insist upon the equality of all the male members, and their right to exhort each

other, especially when moved by the Spirit; and after the opening services, consisting of a hymn or prayer, a pause is usually made to wait for voluntary addresses. Darby carried on for many years an active propagandism in favour of his peculiar theories, and at first with an extraordinary measure of success; but what seemed at first to be a movement great enough to threaten the whole organization of the Christian church was soon effectually checked by internal dissensions among his followers themselves. Darby soon formed a congregation of 700 or 800 disciples in Plymouth, and having established similar associations in London, Exeter, and other places, he commenced missionary operations on a large scale. He himself frequently visited every part of Europe, presiding at meetings, and preaching in English, French, and German, while others carried the principles of the new sect to America and India. A journal, the *Christian Witness*, was also established in its interest, to which Darby was one of the chief contributors. The principal sphere of Darby's labours on the Continent was the Canton de Vaud in Switzerland, where he resided for a considerable time, and made numerous converts. His followers on the Continent are usually called Darbyites.

The Plymouth Brethren distinctly repudiate being a sect, and decline the distinctive designations given them, calling themselves simply Christians or Brethren; but their separate organization, however loose it may be, makes it impossible to relieve them of the necessity of having a separate designation. They recognize no creed, and it would probably be hazardous to give them one; but as they have split up into sections on theological differences they cannot be regarded as indifferent to the opinions held by those with whom they associate. In general their views may be held to be a compound in various proportions of Calvinism and mysticism. The point on which they split in Plymouth was a doctrine regarding the human nature of Christ propounded by one of their teachers called Newton, which Darby regarded as a dangerous error. This produced a threefold division, the adherents of Darby and Newton being in direct antagonism, while a third party, represented by the celebrated George Müller, declined to join either party. The Plymouth Brethren professedly model themselves upon the primitive church, and at an early stage of the movement there was a tendency towards the adoption of the principle of community of goods. They also, in general, hold millennialian views, and Darby carried out minutely the allegorical interpretation of the ceremonial, and other figurative parts of the Old Testament. The interpretation of prophecy, as filling up in detail the entire course of history, is another peculiarity of Darby and the Plymouthists. They baptize adults and administer the sacrament, which each takes for himself, each Sunday. At their meetings a pause of unbroken silence ensues when no one is moved to speak. They hold both civil governments and ecclesiastical organizations to be under divine reprobation, the former as atheistic, the latter as in a state of apostasy.

PLYMOUTH SOUND, an arm of the sea, on the south-west coast of England, between the counties of Devon and Cornwall. It is about 3 miles wide at its entrance, bounded by elevated land, which descends abruptly to the sea. It contains Drake Island, which is fortified; and Eddystone Lighthouse lies 11 miles below the breakwater. See PLYMOUTH.

PNEUMATIC DESPATCH. In our article ATMOSPHERIC RAILWAY we have given an account of the early attempts made to adapt the principle of atmospheric propulsion to special applications of the

system of conveying goods and passengers by lines of rails. Although these attempts have hitherto proved abortive in respect to the conveyance of passengers and heavy goods, this means of propulsion has been successfully applied in the case of large parcels, and a very important development of it has taken place in regard to the internal transmission of telegrams in large towns.

The application of the principle of the pneumatic despatch to the internal transmission of telegrams has been necessitated by the growth of the telegraph business. The messages received, whether for transmission or delivery in London and other large cities, have to be collected or distributed through a number of district offices. The two principal means of collection and distribution previous to the introduction of the pneumatic despatch were by messengers or conveyances, and by telegraphic communication between the district and head offices. The former method was too slow and the latter both lost time through the accumulation of messages and occasioned an additional risk of error from the necessity it involved of repetition of the message. The Electric and International Company first adopted the system of sending packets from place to place through pneumatic tubes on the principle of alternate pressure and exhaustion of the air, the carrier containing the messages to be transmitted being sent to its destination by means of compressed air, and sucked back with fresh messages by means of exhaustion. This system, introduced by Messrs. Latimer Clark and Varley, requires a separate tube between each pair of stations, and admits of only a single despatch at a time. It has hitherto been most used in Great Britain, but a system of laying tubes in circuit for the continuous transmission of despatches, by means of an uninterrupted air-current in one direction, was adopted in Berlin by Messrs. Siemens and Halske in 1863, and introduced by the inventors in London in 1870. The other system, however, is still chiefly employed by the post-office in London as well as in other large cities of Britain. The pipes used are mostly 2½ inches in diameter and are made of lead, being incased in pipes of iron for protection. In London they have a total length of 35 or 40 miles. Sometimes they are laid double, one tube being for sending, the other for receiving. The carriers are made of gutta-percha, are cylindrical in form, and covered with felt. With a pressure of 10 lb. per square inch a carrier traverses a 2½-inch pipe of 1000 yards in one minute, while it takes about 2½ minutes to run a distance of 3000 yards. In Liverpool, Manchester, Glasgow, Dublin, Birmingham, &c., this system is also in use. It is also in use in America. In Paris a different system prevails, there being here a continuous circular line or lines proceeding from a central station, and there are also a number of intermediate stations. The means of propulsion is compressed air. The trains are divided into two classes—omnibus trains, which stop at intermediate stations, and expresses, which go direct to their destination. An omnibus train leaves the central station every quarter of an hour, and makes the circuit, returning to the station from which it started in twelve minutes. Express trains to the busiest stations are intercalated between the omnibus trains. A separate box is put in the omnibus train for each station with messages to be transmitted. This is taken out at the station and another substituted with messages for despatch, so that the train returns with as many boxes of despatches as were sent out.

For some years a pneumatic system was worked in London for the conveyance of mail-bags, &c., between the General Post-office and the North-Western Railway station, Euston Square. This system,

which was in two parts, was worked from a central station in Holborn. The length of the tube from Holborn to Euston Square was 3080 yards, that between Holborn and the Post-office was 1658 yards. The tube formed a section in the shape of a flattened horse-shoe, or letter D lying on its straight side. It was 5 feet in width and 4 feet 6 inches in height at the centre. The carriages were of the same shape as the tube, but of a slightly smaller area, a flange of india-rubber surrounding the carrier so as to make it form a piston, but in practice it was not found necessary that the piston should be perfectly air-tight. The straight portions of the tube were made of cast-iron, the curved portions of brickwork lined with cement. The currents by which the carriages were propelled were created by a fan 22 feet 6 inches in diameter, which was put in rotation by a steam-engine with a pair of 24-inch cylinders, with 20-inch stroke, geared so that one revolution of the engine gave two of the fan. The trains were propelled from the central point by pressure, and drawn to it by exhaustion.

As an allied subject we may here refer to the transmission of *pneumatic power* through cities, which has recently been introduced; that is, the supply of compressed air from a central station to places at some distance for the purpose of driving machinery, working cranes, elevators, &c. In Paris this has been in operation for some time, and there are many miles of pipes through which the compressed air is transmitted at a pressure of 80 to 90 lbs. per square inch, there being powerful compressing engines at the central station. Recently works have been established in Birmingham for the same purpose with the prospect of permanent success.

PNEUMATICS, the science of gases, is a branch of hydrodynamics, the science of fluids generally. The principles of static pneumatics, that subdivision of the subject which deals with gases at rest, are comparatively well known. It is difficult in investigating the kinetic phenomena of gases to eliminate viscosity or internal friction, and as in the kinetics of fluids generally, experiments have merely led to empirical rules upon which indeed theories may be built, but these theories are only used as guides by experimenters. Viscosity or molecular friction is noticeable in solids and fluids; but when the effects of forces on solid bodies are investigated, the mathematical treatment of the subject, the bodies being regarded as rigid, and therefore as having no internal friction, leads to laws which agree very closely with observation and experiment. But the observed phenomena of fluids are those in which viscosity plays a most important part, and the science is not advanced enough for any but a very incomplete mathematical treatment. Professor Clerk Maxwell's theory of molecules (see GAS), and his experimental investigations of viscosity, Mr. McFarlane's experiments on the viscosity of solids, Sir William Thomson's theories of vortex motions and magnetism, supported by Faraday's experiment of the rotation of the plane of polarization of light, &c., and other investigations in physics, will, no doubt, lead in time to a satisfactory knowledge of molecular kinetics. The subject has intimate relations with magnetism, light, heat, and electricity. At present in dealing with practical questions, the flow of fluids in channels, centrifugal pumps and fans, turbine, screw and other marine propellers, &c., scientific men depend firstly on the great law of conservation of energy, and secondly on the results of special experiments.

Gases at rest transmit pressure freely in all directions. They have weight, so that in a mass of gas under gravitating force the pressure increases downwards. The experimental determination of the weight

of the atmosphere surrounding the earth is fully explained in the articles **BAROMETER, AIR, ATMOSPHERE**. It is found that near the level of the sea every surface exposed to the atmosphere sustains a normal pressure equal on an average to the weight of a column of mercury whose base is this surface and whose height is 30 inches, or to the weight of a column of water whose height is about 34 feet. This is the maximum height to which water can be raised in a pump, as was observed by Galileo. The pressure of a gas; the relations between pressure and volume in a given quantity of gas; the relations between gases, vapours, and liquids; and other important phenomena, which are usually treated of in works on pneumatics, will be found in the articles just referred to, and also in **AIR-PUMP, PUMP, MANOMETER, PRESSURE, METEOROLOGY, MATTER (CONTINUITY OF THE STATES OF)**.

PNEUMONIA (Greek, a disease of the lungs, from *pneumōn*, lung), acute inflammation of the lung substance. It is generally ushered in by restlessness and febrile symptoms, succeeded in a short time by shiverings or rigors. These are followed by acute pain in the affected side, distressed breathing, a high pulse, an increased temperature of the body, a distressed and anxious countenance, and a livid appearance of the skin, due to the blood not being properly oxygenated. There are also headache, great thirst, loss of appetite, severe prostration, and painful cough, which in a few days is accompanied by a rust-coloured expectoration. The base of the lung is the portion of the organ which is most generally attacked, and the right lung is twice as often affected as the left. Pneumonia is a disease which is seldom fatal if it is detected in time and is judiciously managed. The most important points to attend to are the following:—To keep the patient quiet in bed in a well-ventilated and moderately-warm room, to see that the bowels are gently moved, the application of hot poultices, or in some instances a fly-blister over the affected part, the administration of a simple yet very nourishing, and in some cases a stimulating diet, and medicines which tend to promote a free action of the skin and reduce fever.

PO (anciently *Padus* or *Eridanus*), the largest river of Italy, in respect both of its length and its volume of water, and hence styled by the Italians the Father or King of Rivers. It rises on the confines of France and Piedmont in Mount Viso, one of the Cottian Alps, and flows rapidly eastward through Piedmont in the character of a mountain torrent, till, after having been augmented by several other mountain streams, it reaches Lombriasco. Here it begins to be a majestic stream, and, turning northward, passes Turin. Shortly after it assumes an easterly course, and reaching the confines of Lombardy is greatly augmented in volume by the accession of the Ticino on the left. Here, still continuing eastward, it forms the boundary between Lombardy and the Emilian Provinces till about lon. $10^{\circ} 40' \text{ E.}$, where it turns northwards and then eastwards through Lombardy. About lon. $11^{\circ} 15'$ it meets the Venetian frontier, after which it separates first Venetia and Lombardy and then Venetia and the Emilian Provinces. It afterwards throws off several branches, and finally, dividing into two principal arms, enters the Adriatic by two mouths about 12 miles distant from each other, the larger and northern arm taking the name of Po-di-Maestra, and the smaller but most frequented that of the Po-di-Goro, which continues the boundary-line between Venetia and the Emilian Provinces. Its principal affluents are, on the left, the Clusone, Sangone, Dora-Riparia, Stura, Dora-Baltea, Sesia, Agogna, Terdoppio, Ticino or Tessin, Olona, Lambro, Adda, Ollo, and Mincio; on the right, the

Vraita, Tanaro, Scrivia, Trebbia, Nura, Taro, Parma, Enza, Secchia, and Panaro. Its direct course, almost due east, is 270 miles; its total course, including windings, about 450 miles. After the first 60 miles it begins to be navigable by small barges, but its navigation throughout meets with numerous interruptions. After receiving the Adda its average breadth is about 650 yards. Below Piacenza, which it passes on the right about lon. $9^{\circ} 40' \text{ E.}$, it is confined by artificial embankments, which are said to have originated with the ancient Etruscans, and notwithstanding the immense sums which have been expended upon them, and the engineering skill which has been exerted in order to render them perfectly secure, the most disastrous inundations have repeatedly taken place. The embankments themselves have in one sense added to the danger. The deposits made by the river are perpetually tending to raise the level of the water. This makes it necessary to make a corresponding increase in the height of the embankment, and the effect of these combined operations has been to lift the river so high above its natural bed that it is actually on a level with the tops of the houses in the city of Ferrara. The Po is well supplied with fish, including, among others, the shad, salmon, and sturgeon. The last is not fished in any other river of Italy.

POA. See **MEADOW-GRASS**.

POACHING, a non-legal term applied to the stealing of game or the entering on another's fishery without leave for the catching of fish. For the law relating to the poaching of game see **GAME LAWS**. With regard to private property in fisheries, according to the law of England, there can be such a thing only in the case of streams where there is no ebb or flow, ponds wholly inclosed by a person's land, and lakes bordered by the property of different persons, unless the exclusive right of fishing in a public river, that is, one in which there is ebb and flow up to the tidal limit, or a portion of the sea, has been granted to a person's predecessors by royal franchise at least as early as the reign of Henry II. Such is the law of the Magna Charta, which deprived the crown of the right of conferring such franchises in future, although it continued all such as had not been conferred subsequently to the date mentioned. When a person claims the privilege of an exclusive fishery in a portion of the sea or a public river, it falls upon him to prove his right; but if he can prove that such right has been enjoyed by his predecessors for 200 years it will be assumed that it dates from the reign of Henry II., and the right will be admitted. When a person's land adjoins a stream where there is no ebb and flow that person is assumed to have an exclusive right to fish in the stream as far as his land extends, and up to the middle of the stream; and any person who claims the right of fishing in that part of the stream, either as an exclusive right against the proprietor of the land on the bank as well as all others, or as a right which he enjoys in common with others (a common of piscary), is required to prove his right. It has been doubted whether there can be an exclusive right of fishing belonging to one person when the land on the banks of a stream belongs to another; yet it seems to have been established that such a right may be acquired by a grant or demise immediately from the owner of the soil. When a person's property adjoins both banks of a stream that person is of course assumed to have the exclusive right of fishing in the whole breadth of the stream. So also when a person's land incloses a pond, the fish in that pond belong to him. Where several properties are contiguous to the same lake the right of fishing in that lake belongs to the proprietors, although it is often a difficult matter to say how that right is

divided among them, a good deal depending on the title of each proprietor. In any case the public have no right to fish in such lake even when it is bordered at some part by a public road. In England there is no special law as to the property in salmon fisheries. Every person who has a right to fish in any sea or stream has the right to fish for salmon as well as for any other fish, subject, of course, to the regulations as to seasons and means contained in the Salmon Fishery Act. The law as to poaching in private fisheries is contained in the twenty-fifth section of the Larceny Act (24 and 25 Vict. cap. xvi.), where it is declared that any person not being an angler who shall take or destroy, or attempt to take or destroy, any fish in any fishery which is private property, but not in land belonging to the dwelling-house of the owner of the fishery, shall forfeit, in addition to the value of the fish, any sum not exceeding £5; and if the fishery is in land belonging to the dwelling-house of the owner, a person not an angler unlawfully and wilfully taking and destroying fish from it shall be guilty of a misdemeanour. Such a fish-poacher, when caught in the act, may be arrested by anybody; but if he escapes to the highway he can only be summoned before justices in the ordinary way. If arrested in the act he must be taken before a justice within a reasonable time, and charged with the offence. Although he may be arrested in the circumstances mentioned a fish-poacher cannot be deprived of the fish which he may have caught. Anglers pursuing their sport during the day-time on other persons' property are more mildly dealt with. They cannot in any circumstances be arrested, and even when summoned before a justice and convicted of the offence are not liable to so severe penalties as other poachers. If they have been angling within the land belonging to the dwelling-house of the owner of the fishery they are liable to a penalty not exceeding £5, and in other circumstances to a penalty not exceeding £2. If found angling in another's fishery an angler, although he cannot be arrested, may be deprived by the owner or his servant of his fishing implements; but in this case he is liable to no further penalty. The same law as obtains in England with regard to fisheries and poaching of fish applies also to Ireland, except as to property in oyster-beds, for the law relating to which see OYSTER.

In Scotland the law as to property in fisheries, as well as the poaching of fish, is considerably different from English law. There salmon are in both respects distinguished from all other fish. As to property in salmon fishings that is held to be originally vested in the crown, not only for the rivers of Scotland but also for the coasts round Scotland, and no person accordingly is allowed to fish for salmon unless he possesses a grant or charter from the crown enabling him to do so. The fact is, however, that nearly all the great landed proprietors do possess such rights with reference to the waters which are inclosed in, which run through, or are contiguous to their lands. When the right of salmon-fishing is in the hands of several persons for the same river, none of those exercising the right can use any fixed engine for catching salmon, but must use the net and coble. There are special statutes regulating the salmon-fishings in the Tweed, Solway, and the rivers flowing into these, as also for some other rivers, but these do not differ materially from the law which generally prevails. As to other fish than salmon the right of fishing for them, as a general rule, belongs to the owner of the land on the banks. The punishment for poaching salmon in Scotland in 'any river, stream, lake, water, estuary, frith, sea, loch, creek, bay, or shore of the sea, or in or upon any part of the sea within 1 mile of low-water mark,' is a fine fixed by

act 7 and 8 Vict. cap. xov. at not less than 10s. nor more than £5, together with the forfeiture of the fish taken, and the boat, tackle, &c., employed by the poacher, if the sheriff or justice think fit. Any one not an angler poaching trout or any other fresh-water fish renders himself liable to a penalty of £5, besides forfeiting the fish caught. If he be caught in the act of using a net for poaching such fish he may be arrested, but not unless; but even when he may not be arrested his boat and fishing implements may be seized, unless he is fishing with an angling-rod. A person who merely angles for trout in places where he has not got leave to fish can neither be arrested nor deprived of his fishing implements, nor be punished by any penalty, but is merely liable to an action at law.

POCAHONTAS, daughter of Powhatan, a celebrated Indian warrior in Virginia, was born about the year 1595. She discovered the warmest friendship for the English, who colonized Virginia when she was about twelve years old, and was eminently useful to the infant settlement. The first remarkable evidence of this attachment was displayed in 1607, when Captain John Smith was taken prisoner by her countrymen, and brought before Powhatan that he might put him to death. As the savage lifted his club to dash out the brains of the prisoner, whose head was laid on a stone at his feet, Pocahontas threw herself on Smith's body, and prevailed on her father to spare his life. Captain Smith was suffered to return to Jamestown, where he sent presents to Powhatan and his benefactress. From this time Pocahontas frequently visited the settlements of the whites, to whom she furnished provisions at times when they were particularly needed. In 1609 Powhatan invited Smith to pay him a visit, promising him a supply of provisions, but designing to entrap and destroy him and his party. Pocahontas, becoming informed of this plot, ventured through the forest at midnight to disclose it to Smith. After Smith had left the colony in 1612 she fell into the hands of an English expeditionary party, who kept her as a valuable hostage. During her detention Mr. Rolfe, an Englishman, became attached to her, and offered her his hand. It was accepted, and the consent of Powhatan being obtained, the marriage was solemnized in presence of the uncle of Pocahontas and her two brothers. This event relieved the colony from the enmity of Powhatan, and preserved peace between them for many years. In the year 1616 Pocahontas embarked with her husband and several Indians of both sexes for England, where she was baptized, exchanging her Indian name for that of Rebecca. In the following year (1617), while about to embark at Gravesend, in company with her husband and an infant son, to revisit her native land, she died, of grief, it was said, at having discovered Smith, to whom she was much attached, and whom she thought to be dead, to be still alive. She left one son, who was educated by his uncle in London, and whose descendants are still said to exist in the state of Virginia. Such is the romantic tale that is usually told of Pocahontas, but E. D. Neill, United States consul at Dublin, in a work entitled *English Colonization of America*, published in 1871, has deprived her story of a good deal of its romance. According to him, Pocahontas is first heard of as 'tumbling wheels' in the market-place of an English fort, and next as living with a volunteer captain called Cookham. She afterwards separated from him, and was betrayed by her uncle Patoromek to Captain Argall, the deputy-governor of Virginia. She subsequently did marry a Mr. Rolfe, and was brought to England, where she excited a good deal of curiosity, and died while preparing to return to America.

POCHARD (*Fuligula*), a genus of Anatidae or Ducks, distinguished by possessing a bill not exceeding the head in length, and of broad, flat conformation. The bill is depressed at the tip, the apex of the upper mandible terminating in a hooked or curved process. The lamellæ or plate-like processes which fringe the sides of the bill are not prominent or projecting, and are of thin structure. The legs are short, the hinder toe being small, raised on the back of the foot, and provided with a short broad lobe. The tail is generally short and rounded, as also are the wings. The inferior larynx of the male ducks is of strong bony construction. These ducks inhabit the Arctic regions, but migrate southwards in winter to the coasts of Europe and North America; and they even occur in Asia and in the southern hemisphere also. They are marine in habits, and feed upon crustaceans, worms, molluscs, and aquatic plants. The plumage is thick and dense, that of the male Pochards being frequently lustrous, and usually more brilliant than the plumage of the female.

The Common Pochard (*Fuligula* or *Æthya ferina*) breeds in the northern regions, and visits Britain in winter. In size it is smaller than the Mallard. The head and neck are coloured bright chestnut. The eyes are red. The flesh is much valued as an article of diet. The Red-headed Pochard (*F. americana*) is a closely related form. The *Fuligula glacialis*, or Long-tailed Duck, is another species related to the more typical Pochards. The male of this latter species possesses the two middle feathers of the tail greatly elongated and of narrow form. The Scaup Pochard (*F. marila*) possesses the head and neck of a black colour, beautifully glossed with green hues. The Tufted Pochard (*F. cristata*) possesses a crest of feathers borne on the head. This form is coloured black, and possesses white bars on the wings. The breast and belly are white, as also are the sides. The Canvas-backed Duck of North America (*F. —* or *Æthya*—*Vallisneria*) derives its specific name from its habit of feeding on the *Vallisneria spiralis*, an aquatic plant. This species is larger than the Common Pochard. The Canvas-backed Duck arrives in the United States from the northern regions during the month of October, and in November or December they collect in large flocks, and are shot for the sake of their flesh, which is highly esteemed. This form has the forehead and cheeks of a dull brown, the back and belly being white, marked with numerous fine black lines. The White-eyed Pochard (*F. Nyroca*) and the allied species (*F. australis*) represent another section of the genus, sometimes separated as a distinct genus *Nyroca*.

POCO (Italian for 'a little'), a term used in music in such phrases as *poco forte* (*p. f.*), rather loud; *poco animato*, with some animation; and so forth.

POCOCKE, EDWARD, oriental scholar, was born in November, 1604, and educated at the University of Oxford, his native place, becoming a fellow of Corpus Christi. In 1629 he was ordained priest, and next year he went as chaplain to the English factory at Aleppo, where he resided five years and applied himself there to the cultivation of oriental literature and the collection of manuscripts. He was employed by Laud to collect manuscripts and coins for the University of Oxford; and in 1636 was invited to fill the newly-founded Arabic professorship at Oxford. In 1637 he undertook a second voyage to the East, and remained some time at Constantinople. He returned in 1640, and in 1642 became rector of Childrey, Berks. In 1648 he was appointed Hebrew professor at Oxford, to which the king, then a prisoner in the Isle of Wight, added the rich canonry of Christ Church; and the grant was confirmed by the Parliament. In 1649 he published *Specimen*

Historiæ Arabum (4to, reprinted at Oxford in 1806). In 1650 he was deprived of his canonry for refusing to subscribe the engagement required by the Parliament. In 1655 he published some of the writings of Maimonides, under the title of *Porta Moisi*, and assisted in Walton's Polyglot Bible. In 1658 appeared his Latin translation of the *Annals* of Eutychius. The Restoration in 1660 enabled him to recover his canonry, and he continued to hold his living at Childrey. The same year he printed an Arabic translation of Grotius' work on the Truth of Christianity. In 1661 he published *Lamiato 'I Ajam*, an Arabic poem, with a Latin translation and notes. His edition of Abulfaraj's *History* with a Latin translation appeared in 1663, and in 1677-91 he issued a commentary on the minor prophets. He died at Oxford on Sept. 10, 1691. His theological works were published at London, in two vols. folio, in 1740.

POD, in botany, a long-shaped fruit containing several seeds. When the fruit on coming to maturity opens longitudinally on both sides, disclosing the seeds arranged in a single row on one of the sutures (the ventral, or that next the axis of the plant), it is called a *legume*, as in the pea or bean. Sometimes the pod is twisted, sometimes vermiform. When the pod is divided into sections by the contraction of the fruit above and below each seed, and these segments fall away separately when the fruit is ripe, it is called a *lomentum*. When it opens by two longitudinal valves, disclosing two rows of seeds on opposite sides of a central frame called a *replum*, it is called a *siliqua*, a form of fruit exemplified in some of the Cruciferae. A short siliqua is called a *silicula*.

PODAGRA (Greek, literally 'a trap for the feet'), that species of gout which recurs at regular intervals, attacking the joints, particularly the large joint of the great toe, and attended with sharp pain. The pain is described as resembling that produced by laying a burning coal upon the toe, or by forcing asunder the joint with a red-hot iron. When the disease is violent the whole foot is so sensitive that the slightest pressure, the lightest touch, or even the agitation occasioned by a strong draught of air, causes the most excruciating pain. The first stage of the disease is peculiarly painful, but in a week or a fortnight the inflammation subsides, and the pain ceases. As the swelling of the affected joint increases, the pain usually markedly subsides, and soon the joint may return to an apparently normal condition. But even after the first attack a deposit of urate of soda takes place in the tissues of the joint, which may leave some degree of stiffness. After several attacks the deposit becomes manifest in the accumulation of this material, causing the so-called 'chalk-stones'. The attacks usually recur once a year, in spring or autumn. The notion that there is no remedy against podagra is erroneous. By shortening the period of inflammation the secretion of the gouty matter may be promoted, and the pain more speedily assuaged. In the interval of the attacks, if attention is paid to the diet and manner of living, if the patient confines himself to simple food and avoids the exciting causes of the disease, its violence may be gradually diminished, and the disease itself may be eradicated; while, by the neglect of these precautions, it continually becomes aggravated, and, as the system grows weaker, irregular and retrocedent, in which stage it is often fatal. See **GOUT**.

PODALIRIUS. See **ÆSCULAPIUS**.

PODESTA, an Italian word, derived from the Latin *potestas*, power, equivalent in its original meaning to a holder of power or authority. In several of the Italian cities it is applied sometimes to the chief of police, and sometimes to the chief magistrate or burgomaster. The office was first established in the

twelfth century by Frederick I. in the principal towns of Italy, and was in the middle ages a much more important one than it is now. The podestà was intrusted almost with dictatorial power, the only limitation being that there was an appeal from his decisions. Some of the dangers likely to arise from a single individual having so much power in his hands were guarded against by confining his authority to a short period, a year or half a year; yet it was not always easy to enforce this regulation against the podestà, and when the municipal government began to totter in most of the towns of Italy, this office often served as a preparation for the establishment of princely government. Venice and Genoa used to govern the towns which they had brought into subjection by means of officers bearing this title.

PODIEBRAD and KUNSTAT, GEORGE BOCKOV, the son of Herant von Kunstat and Podiebrad, one of the greatest and wealthiest of the Bohemian lords of the Hussite party, was born in 1420. When a mere youth he entered with all his soul into the Hussite movement, but during the reign of Sigismund remained attached to the moderate party. When, however, the Catholics had succeeded in securing the election of Albert V. of Austria as Sigismund's successor on the German throne (1438), Podiebrad allied himself to the utraquistic states in Tabor, and invited Casimir of Poland to become King of Bohemia. They were, in consequence, involved in a war with Albert, and so closely pressed that they were obliged to shut themselves up in the castle of Tabor. Here their ruin seemed inevitable, but Podiebrad, by a bold movement, effected their relief, and obliged Albert to retire upon Prague. Albert, however, still retained the title of king. Podiebrad was now held in the highest esteem by the utraquists, and was, after Lipa, the first man of their party. After the death of Albert in 1439 Lipa was chosen regent of Bohemia, and this office he continued to hold after the birth of Ladislas, Albert's posthumous son, early in the following year. Under Lipa's regency Podiebrad held the chief command in utraquist Königgratz, and after Lipa's death became his successor (1444). Opposition, however, arose, and it was not till 1451 that he was universally recognized as regent. In 1453 the young King Ladislas came to reside at Prague; but Podiebrad still continued to hold the reins of government, and ruled with more authority than ever. He gave a vigorous impulse to commerce and agriculture, and made and enforced many wise regulations for the well-being of the people. He thus gained so much popularity and esteem that on the death of Ladislas in 1457 he was continued in the office of regent, and in March, 1458, was elected king by a unanimous vote of the assembled states. He now displayed the full force of his talents. In a short time he was acknowledged in Moravia, Silesia, and Lusatia, as well as by the Emperor Frederick and the German electors. After he had secured his throne he devoted his whole attention to the internal improvement of the state. He placed the currency on a proper footing; erected schools and churches, and endeavoured, by friendly conference, to terminate religious animosities. To meet the complaints of the Roman Catholics he banished the Taborites, Picardites, and other sects from the country, and tried to make arrangements with the pope. In this, however, he was unsuccessful; and in 1463 the pope publicly denounced him as a heretic, and then, though urged by all neighbouring princes to moderation and peace, excommunicated him. The Papal legate, Rudolf, skilled in intrigue, soon produced a rising among the Catholics, and in 1466 a German crusade was formed against Bohemia. The invaders having been defeated at Riesenberg, the pope reiterated his excommuni-

cation. After making an appeal to a general council of the church, Podiebrad recalled the Taborites, whom he had driven into exile, defeated an army of Silesian crusaders at Munsterberg and at Frankenstein, and a German army at Neuern; and in 1468 despatched an army under the command of his son Victorin to invade Austria, the Emperor Frederick having also betrayed him. Matthias Corvinus, who, although he was the son-in-law of Podiebrad, and indebted to him for his release from captivity when called to the throne of Hungary, had long cherished designs on Bohemia, took advantage of this circumstance to make war upon his benefactor. At the invitation of the emperor he drove Victorin out of Austria, and penetrated into Moravia, where he came to an understanding with the chiefs of the league that had been formed against Podiebrad, and marched against that prince. But the generalship of Podiebrad was again successful. In 1469 he hemmed in the Hungarian army at Willemow. Matthias Corvinus sued for a truce, which was generously granted by Podiebrad, who allowed his enemy to withdraw from his critical situation unmolested. In spite of this generous treatment Corvinus, a few months later, had himself crowned at Olmütz, by the chiefs of the league, King of Bohemia. Podiebrad now had recourse to more energetic measures. In order to secure the aid of the Poles he assembled a diet at Prague, and declared the successor to the throne of Poland to be his own successor, while his sons should only inherit the family estates (1469). The diet, with reluctance, adopted the proposal. The Poles were thus immediately drawn to his side; the Emperor Frederick also declared in his favour: and his Catholic subjects also became reconciled to him. Shortly after he destroyed the infantry of the Hungarians, and Matthias Corvinus hastily fled with his cavalry. He thus saw himself at last completely secured in his kingdom, but no sooner was this accomplished than he died (1471), before he had time to carry out his great schemes for the benefit of his country, and others having a much wider scope. His sons, Victorin and Henry, returned to the rank of Bohemian nobles, and in the stormy days which succeeded did not render much service to their country.

PODIUM, in architecture, a long pedestal supporting a series of columns. It is called a *stylobate* when the columns stand on projecting parts of it.

PODOLSK, or PODOLIA, a government in Russia, bounded north by Volhynia, north-east by Kiev, east and south by Kherson, south-west by Bessarabia, and west by Austrian Galicia; greatest length, north-west to south-east, 280 miles; greatest breadth, 110 miles; area, 16,241 square miles. The surface is on the whole level. The climate is temperate, bringing both the vine and the mulberry to maturity; and the air is generally salubrious, though in some quarters endemical diseases occasionally prevail. The soil is very much encumbered with stones, but is notwithstanding of remarkable fertility, producing corn, which, after satisfying the consumption, leaves about one-third of the whole for export. The principal crops after corn are hemp, flax, tobacco, and hops. The meadows and pastures are extensive, and of great luxuriance, rearing immense herds of cattle, which are of an excellent breed, and much prized in Germany, to which they are extensively exported. Large quantities of fine melons, gourds, and cherries are raised, and the forests furnish excellent ship-timber. Manufactures have made little progress. The trade, in addition to agricultural produce and cattle, embraces a considerable number of small articles, and is almost entirely in the hands of the Jews. Education is under the superintendence of the University of Kiev, and is in a miserably neglected

state. Podolak is divided into twelve districts, and together with Volhynia is under the military governor of Kiev. The chief town is Kamenetz. The government of Podolia has belonged to Russia since the second partition of Poland in 1798. Pop. (1897), 8,081,518.

PODOPHTHALMATA ('stalk-eyed'), a division of the great Crustacean class (see CRUSTACEA), the members or groups of which are primarily distinguished by the possession of compound eyes supported upon movable stalks, often of great comparative length; hence the name 'Stalk-eyed Crustacea', in contradistinction to those with the eyes destitute of stalks, and which are accordingly termed 'sessile-eyed'. This division includes the familiar Crabs, Lobsters, Shrimps, and their allies. See also CRUSTACEA, CRAB, LOBSTER, SHRIMP, &c.

PODOPHYLLIN, a resin obtained from the root-stock of an American plant (*Podophyllum peltatum*), belonging to the order Ranunculaceae. It is of a brownish-yellow colour, dissolves readily in alcohol, and has been admitted to the pharmacopœias of many countries as a purgative. It is particularly beneficial in cases of sluggish liver, having much the same effect as mercury, but in some constitutions produces severe griping; hence it is usually given along with other medicines, the whole being made up in pills.

POE, EDGAR ALLAN, a celebrated poet and romantic writer, was the son of David Poe, a law student at Baltimore, United States, who made a runaway marriage with an actress, and himself took to the stage. Griswold, his first biographer, states that he was born at Baltimore on January, 1811. The poet himself placed his birth in the year 1818, but in this he appears to have been wrong. The most recent authorities agree in stating that he was born at Boston on the 19th of January, 1809. Both his parents died within a short time of each other, leaving three children in a state of complete destitution. Edgar, the eldest, attracted by his beauty and precocious intelligence the attention of Mr. Allan, a wealthy merchant, by whom he was adopted and brought up. It was from him that he took his middle name. In 1816 he was taken by his benefactor and his wife to England, and placed in a school at Stoke-Newington, near London. In 1820 he was brought back to America, and after attending for some time a school at Richmond, in Virginia, entered, when he was about seventeen years old, the University of Virginia at Charlottesville in that state. Here he displayed good abilities, but got connected with a gambling set, and incurred heavy debts at play. These Mr. Allan refused to pay, and removing young Poe from the university he put him into his own counting-house at Richmond. This life did not suit the youthful poet, so he decamped to Boston where he was able to bring out his *Tamerlane* and other poems, in 1827. When his money was all gone he enlisted in the United States army, under the name of Edgar A. Perry, and served with credit for more than a year, being promoted to the rank of sergeant-major. He now renewed communications with his friends, who procured his discharge, and obtained for him an appointment as cadet in the military academy at West Point, but in a short time he was expelled for drunkenness and insubordination. Mr. Allan, his benefactor, now fairly threw him off, and ceased to hold any intercourse with him from that time. Before entering the military academy he had published a new edition of his poems, with certain additions, the volume being entitled *Al Aaraaf, Tamerlane, and Minor Poems* (Baltimore, 1829). Having gained the prize offered by the proprietor of the Baltimore Saturday Visitor for a

tale and poem, he was introduced to the notice of Mr. White, who in May, 1835, founded a magazine called the Southern Literary Messenger at Richmond, and appointed Poe the editor. To this magazine he contributed some of his most extraordinary tales, revealing a wild and terrible imagination. He continued to edit this magazine till January, 1837, when he was dismissed, owing to his dissipated habits. During his stay at Richmond he married his cousin, Virginia Clemm, a beautiful and amiable girl. After being dismissed from the editorship of the Southern Literary Messenger he left Richmond, and removed in the course of the same year successively to Baltimore, Philadelphia, and New York, in which last place he became a contributor to the New York Review, and in 1838 published a story entitled *The Narrative of Arthur Gordon Pym*. In the same year he returned to Philadelphia, where from May, 1839, to June, 1840, he edited Burton's Gentleman's Magazine, and in the latter year published a collection of all the stories he had written, under the title of *Tales of the Grotesque and the Arabesque*. From November, 1840, to about April, 1842, he was editor of Graham's Magazine, and wrote for it some of his choicest productions. In 1844 he removed to New York, and in the year following published his wonderful poem of *The Raven*, which took the world by storm by its weird-like and mysterious beauty. Numerous other pieces were contributed by him to various magazines and periodicals; but all the advantages of genius were insufficient to cope with the degrading influences of evil habits, and his necessities became so great that an appeal to the public for pecuniary aid was made on his behalf by one of his friends. In 1847 his wife died; he himself fell ill, and was tended with the utmost solicitude by his mother-in-law. In 1848 he delivered a series of lectures on the constitution of the universe, afterwards published under the title of *Eureka, a Prose Poem*. In 1849 he went to lecture in Virginia, and on his return to New York passed through Baltimore, where he fell in with some acquaintances, who invited him to drink. He lost all command of himself; was found in a state of helpless intoxication in the street; was conveyed to the hospital, and died there on the 7th October, 1849. A more melancholy career than that of Poe can scarcely be imagined. It is now known that the memoir of Poe by Rufus Griswold is the work of a malignant enemy, and wholly untrustworthy; and Mr. Ingram, in a sketch of his life prefixed to an edition of his works, has defended him against the grosser charges which have been brought against him, and has shown that in ordinary life he was fairly gentle and tractable; but it is undeniably the case that he was too often the victim of intoxicating liquors, to the effect of which he was singularly susceptible. 'With a single glass of wine,' according to the account of one who knew him, 'his whole nature was reversed; the demon became uppermost, and though none of the usual signs of intoxication were visible, his will was palpably insane.' Among his poetical pieces we have already alluded to *The Raven*, and may mention, in addition, the singularly charming and euphonious lyric of *The Bells*, and the poems of *Ulalume* and *Annabel Lee*. Among the best editions of Poe's works are those of R. H. Stoddard, and John H. Ingram (the latter four vols., Edinburgh, 1874).

POE-BIRD. See HONEY-EATER.

POECILE (Greek, *poikilē*, literally 'variegated'), a portico in Athens, containing a picture-gallery. (See POLYGNOTUS.) The philosopher Zeno taught his doctrines here, whence he was called the *Stoic* (from *stoa*, a portico), and his school the *Stoic school*. See ZENO and STOICIS.

POELEMBURG, CORNELIUS, a painter, born at Utrecht in 1586, became a pupil of Bloemaert, and afterwards went to Rome, where he studied Raphael's works. In 1621 he returned to Holland. Being deficient in design, he confined himself principally to small landscapes, in which he excelled. Rubens adorned his own cabinet with Poelemburg's productions. Charles I. invited him to England, where he painted a portrait of the king and other works, but soon returned home, and died at Utrecht in 1667. His works are rare, and esteemed for delicacy of touch and sweetness of colouring.

POERIO, CARLO, an Italian statesman, born at Naples December 10, 1803; died at Florence April 28, 1867. He was the son of Giuseppe Poerio, who on more than one occasion signalized himself by his determined opposition to the constitutional encroachments of the Bourbon kings of Naples, and thus drew upon himself sentences of exile. Carlo shared the sentiments of his father, and accompanied him in his banishment. On his return to Naples he devoted himself to the law, and rapidly rose into prominence by his readiness to advocate the cause of political offenders. In this way he incurred the displeasure of the government, and was several times arrested and imprisoned for shorter or longer periods. At the time of the revolutionary movements of 1848 he happened to be undergoing one of his periods of confinement, but suddenly saw himself pass from the condition of a prisoner and suspected person to the position of a popular patriot. He was made prefect of the Neapolitan police and minister of public instruction, and cherished the hope of being able to inaugurate a reign of liberty for the Kingdom of the Two Sicilies with the aid of the Bourbons, who were then lavish of their promises. The events of the 15th of May, 1848, when the king bombarded the town of Naples from the forts, disabused him of this illusion, and he then resigned his office and retired into private life. Elected a member of the new parliament, which met soon after, he joined the ranks of the opposition, with which he continued to act till the dissolution on the 12th of March, 1849. Being warned of the intention of government to prosecute him on the charge of complicity in an alleged conspiracy, he refused to seek safety in flight, and after many attempts to convict him of some political offence by a procedure having some appearance of regularity, he was in June, 1850, condemned to suffer an imprisonment of twenty-four years, by a court which refused to hear anything in his defence. In prison he was subjected to the most barbarous tortures and indignities, being compelled to associate with the lowest class of criminals. An account of the persecutions which he and other political prisoners had to endure will be found in Gladstone's famous *Two Letters to Lord Aberdeen*, written from Naples, copies of which were sent by the British government to the court of every European state. In 1859 his sentence was commuted by Ferdinand to transportation, and he was removed to Cadiz and put on board an American vessel with the object of being conveyed to South America; but having convinced the captain of the vessel of the illegality of this proceeding, he induced him to land him in Ireland, along with his companions in misfortune. On leaving the United Kingdom he repaired to Piedmont, where he was received as a martyr. In November, 1860, after the annexation of Naples to the new Kingdom of Italy, he joined the Fanti ministry as minister without portfolio, and his popularity, due to his political character as much as to the sufferings which he had passed through, gave him great influence in the new government. In March, 1861, Poerio, as representative of Naples, was elected vice-president of the Italian chamber of de-

puties, and he remained till his death one of the chiefs of the constitutional liberal party. He was buried at the public expense at Naples, his native city. In the year of his death an *éloge* on him was published at Naples, having the title *Della vita e de' Tempi di Carlo Poerio: Discorso recitato dal Socio S. Baldacchini*.

POET LAUREATE. See **LAUREATE**.

POETRY (from *poet*, the Greek *poietes*, a maker or creator, from *poies*, I make, with reference to the creative power essential to a poet). The numberless unsuccessful attempts to define poetry warn us against circumscribing within the compass of a few words a subject so vast, so variegated, and so interwoven with all the activities of the human spirit. The definitions usually given, even if true, amount only to illustrations or explanations. To make a full exposition of our views on this subject would far exceed our limits. One of the chief traits of the poetical is that it peculiarly affects the imagination and the feelings. When we speak of actions or the creations of genius as poetical, the term implies further that they had their origin in conceptions in which the imagination and the feelings were chief agents. Hence the universality of poetry; hence the preponderance of the poetical in the language and conceptions of early nations. A common idea, the result of experience or simple reasoning, may be conceived (and accordingly expressed) by the poet in such a way as to strike our feelings with peculiar force; or ideas which, though elevated in themselves, are familiar to all, may receive new impressiveness from a new and striking way of expressing them. For instance, the precept to love our enemies; who does not feel that this elevated sentence is rendered still more striking by the illustration of Manu, who adds to the precept, 'like the sandal-tree, which sheds perfume on the axe that fells it!' A great part of poetry, in fact, consists in a striking expression of common ideas. It is gratifying to find a new conception of a familiar idea presenting the subject in a light in which we had never viewed it. But if the language addressed to feeling and imagination chiefly is often used to convey a plain idea poetically, or to give a familiar one a new charm, this language, on the other hand, is often the natural expression of an elevated imagination, which soars through regions to which our wishes, hopes, and faith aspire, and speaks in metaphors because common language is inadequate to express its conceptions. According to its subjects, and the relation which the poet holds to his productions, poetry is divided into the poetry of subjective feeling, or lyrical poetry; narrative poetry, including the ballad and the epic, that branch which presents actions as happening, while the poet himself is kept entirely out of view; dramatic poetry; didactic poetry, in which the ostensible object of the poet is to inculcate moral precepts, or to teach some art or science, although in reality it is to present that art or science to view under its beautiful and generally attractive aspects; and satirical poetry. (See the separate articles on these subjects.)

Poetics is the theory of poetry. It is one of the theories earliest developed—nay, æsthetics grew out of it. Among the Greeks Aristotle treated it in his *Peri poiêtikês* (best edition by Gottfr. Hermann). Horace, in his *Ars Poetica*, or *Letter to the Piso*, shows himself his pupil. In modern times it has been treated by Marc. Hier. Vida, Torquato Tasso, and many other Italians; Nic. Boileau, Jul. Cæs. Scaliger, Ger. Voss, L. Racine, D'Alembert, Marmontel, Baumgarten (the founder of æsthetics), Salzner, Engel, Jean Paul Fr. Richter (in his *Vor-schule der Æsthetik*), Clodius, Lessing, Klopstock, W. von Humboldt, Herder, Schiller, Goethe, the

Schlegels, Müller, Hegel, and others; in English by Blair, Wordsworth, Campbell, Hazlitt, and others.

We may divide the history of poetry into two periods—the one before the birth of Christ, the other since. The Hebrews are the first people from whom poetical productions have descended to our times. Only obscure traces remain of any earlier poetry of the Indians, Persians, Syrians, and Arabians. The religious poetry of the Hebrews is of very ancient date, and possesses a solemn character, distinct from that of the other nations of antiquity. It begins with cosmogony, becomes at a later period of a warlike character, then assumes the form of sacred songs in the time of David, and attains under Solomon (from 1044 to 975) its greatest elevation, after which it assumes a prophetic character. The fragments which have come down to us from the flourishing period of Indian poetry, some centuries before Christ, are of an original character and peculiar delicacy. We next come to classic antiquity, and become acquainted with poetry in the plastic character which it assumed in Asia Minor and Greece, under the influence of the prevailing paganism, which received such rich and various hues from the glowing imagination of the people. Greek poetry may again be divided into three periods: the first of these extends from the earliest times of Greece to the Persian war. Greek poetry begins in Thrace and Asia Minor, and the great national epics of Homer, or the Homerids, the rhapsodists, the cyclic and gnomic poets, indicate a wide diffusion of poetry at that time. Lyric poetry soon attained a peculiar eminence. The second period extends from the Persian war to the time of Alexander the Great. It is the flourishing period of the dramatic art, and of cultivated Greek poetry in general. The third period shows the decline of Greek poetry under the successors of Alexander, and the revival of the same in Alexandria. (See GREECE—Literature.) From the Greeks we turn to their imitators, the Romans, whose language was not employed in poetry till a late period, and who, until the second Punic war, or until the time in which they became closely connected with the Greeks, made only rude essays in poetry. The era of Augustus and Tiberius was the golden age of their poetry, and it thence declined continually until the introduction of the Christian religion, and the irruption of the barbarians. After the Christian religion became prevalent, we find the Latin language applied in the Christian worship to a mystic religious poetry; and later, in the ninth, tenth, and succeeding centuries, employed by learned men in imitations of the old Roman poetry. Contemporary with these we witness the rise of Arabian poetry. (See ARABIAN LITERATURE.) A peculiar poetry sprung up among the French, in the time of the Provençals or Troubadours of the south, and the Trouveres of the north in the eleventh century. In its devotion, valour, and love the spirit of chivalry is apparent. (See ROMANTIC.) This romantic poetry of the Franks declined into mere artificial rhyming after the end of the twelfth century. Under the dominion of Francis I. poetry somewhat revived; but the age of Louis XIV. was the golden era of French poetry, although it often, but in its own manner, imitated the ancients, and modernized ancient materials. Rhetorical elegance and easy wit were its chief aim. (See FRANCE—Literature.) The modern Italian poetry sprung from the Provençal. But a poetry of a natural character began in Sicily after the thirteenth century, and flourished, peculiarly from the time of Dante and Petrarch to that of Ariosto and Tasso, in the thirteenth, fourteenth, and fifteenth centuries, and thence declined into bombast and imitation. (See ITALY—Poetry.) The Spanish poetry appears origin-

ally the sister of the Provençal, but mingled with the oriental character. The earliest Castilian poetry, properly so called, belongs to the thirteenth century; but it began to flourish under the administration of Charles I., and declined under Philip IV. Simultaneous with it, and in connection with it, flourished the Portuguese. (See SPAIN and PORTUGAL, sections Literature.) The German poetry, which is closely connected with the northern, and has its own epic cycle, flourished at various times, and with much variety of character, but most vigorously when free from the influence of foreign models. (See GERMANY—Literature, MINNESINGERS, and MASTERSINGERS.) The origin of the English and Scottish poetry is lost, like that of the German, in the distant period of the bards; it was refined by the Norman French poetry. But the flourishing period of English poetry is placed in the times of Queen Elizabeth, although Chaucer is esteemed the father of modern English poetry. The Scandinavian poetry, otherwise called northern, presents chivalry peculiarly coloured by the northern character, since the thirteenth century, when the German Heldenbuch (book of heroes) was introduced into Norway, and foreign tales became blended with native ones. For further information the reader is referred to the sections on literature in the articles on different countries, and also to Warton's History of English poetry; R. W. Emerson, Poetry and Criticism; Sir Henry Taylor, Critical Essays on Poetry, &c.; Prof. J. C. Shairp, The Aspects of Poetry, and Studies in Poetry and Philosophy; E. C. Stedman, The Nature and Elements of Poetry (1892); &c.

POGGIO BRACCIOLINI, one of the early promoters of classical literature in Italy, was born at Terranuova, between Florence and Arezzo, in 1380 or 1381. On completing his education he went to Rome, where he obtained the office of writer of apostolical letters under Boniface IX., and kept it under the seven following pontiffs. In this capacity he attended John XXIII. in 1414 to the Council of Constance. In 1416 he undertook the task of searching the monasteries for ancient manuscripts; in that of St. Gall he discovered a complete copy of Quintilian, with a part of the Argonautics of Valerius Flaccus, and in other religious houses several of Cicero's orations, and obtained copies of the works of Silius Italicus, Vegetius, Ammianus Marcellinus, Columella, &c. In 1418 on the invitation of Cardinal Beaufort he visited England; but the barbarism of the country at that period soon led him to return to Rome, where he resumed his former office of apostolical secretary. During the disturbances which took place under the pontificate of Eugenius IV. he quitted Rome, and went to reside at Florence. In 1447 he returned to Rome again to enter once more on his old functions under Nicolas V., which he finally resigned in 1453 in order to undertake the office of chancellor of the Republic of Florence. He died in 1459. Poggio was licentious, quarrelsome, and intemperate in controversy; but his sentiments are in general liberal and manly, and he may be deemed the most elegant composer in Latin (the language of nearly all his works) of that period. His writings are numerous, and upon various topics. Many are discussions on moral arguments, a few are philosophical, and several controversial; the remainder are chiefly translations, orations, and letters, the chief fault of which is diffuseness. His *Historia Florentina*, which comprises the period from 1350 to 1455, is to be found in the collections of Gravvius and Muratori. An Italian translation of it by his son was published at Venice in 1476. His *Liber de Nobilitate* is said to be one of the most finished of his works; but his Letters are at the present day the most interesting of all his remains. They make us

acquainted with a multitude of curious facts, of which we should otherwise have been ignorant, and contain a vivid and animated picture of that epoch of the Renaissance, in which, printing not yet having been invented, or not having come into general use, Italian scholars applied themselves to putting in safety all the remains of antiquity that had escaped complete destruction. The whole of the works of Poggio were published together at Basel, 1538. See his life by Shepherd (Liverpool, 1802).

POICTIERS. See **POITIERS**.

POINDING, in Scotch law, a legal proceeding by which the property of a debtor's movables is transferred to the creditor. It is of two kinds, *real* and *personal*. In the former case it is the ground that is poinded, and the creditor may take possession of all the goods on the land which the poinding affects, whether these goods belong to the proprietor or tenant of the land. A tenant's goods cannot, however, be poinded for his landlord's debt to a greater extent than the amount of the term's rent or the arrears due to the latter. No other goods than those of the owner or the tenant are affected by the poinding of the ground. Before a creditor can poind the lands of his debtor he must raise an action, with the object of obtaining what is called a *diligence* for doing so. In an action of this nature both tenants and owners must be made parties, although the conclusion is not a personal one, but refers only to the goods on the ground, which accordingly may be taken possession of without first charging the tenant to make payment, and at any time, even after the original defender is dead or removed. The action is competent to a superior for his feu-duties, to an annual-renter for the arrears of his interest, and in general to all creditors in debts which form a real burden or lien on the land; but is not competent to proprietors, or even to creditors or others in possession of the ground. In personal poinding, which is competent to all classes of creditors in ordinary personal obligations, it is the movable goods and effects of the debtor that are poinded. After a decree allowing the resort to this proceeding has been obtained, the creditor, unless he be a landlord poinding for bygone rents, or a superior for feu-duties, must first charge the debtor to make payment, and wait till the days of the charge have elapsed, before putting the decree in operation. *Plough-goods*, that is to say, horses, oxen, and other goods used in connection with ploughing operations, cannot be poinded during the period of tillage. When the poinding takes place, the goods affected by the proceeding are appraised by two valuers appointed by the creditor, and a schedule of the goods with their appraised values is given to the debtor, who retains possession of the goods, until the date fixed by a warrant of the sheriff or other judge-ordinary for the sale of the goods by public roup. The amount yielded by the sale after the deduction of expenses is handed over to the creditor to the extent of his debt, and if no purchaser appear the goods themselves are handed over to him at their appraised values. The term poinding is also applied to the seizing of stray cattle found trespassing on inclosures, and retaining them until compensation is made for the damage done by them. In the case of no agreement being come to between the owner of the cattle and that of the inclosure, as to the amount of the compensation to be paid, this may be fixed by the proper officers, who will allow to the proprietor of the inclosure a certain sum on account of the damage done, besides a penalty of half a merk for each of the cattle found trespassing, and the expenses of keeping the cattle during the time that they have been detained. (Bell's Dictionary of the Law of Scotland.)

POINT, in geometry, as defined by Euclid, is a quantity which has no parts, or which is indivisible. Points are the ends or extremities of lines. If a point is supposed to be moved any way, it will by its motion describe a line.

POINT, an iron or steel instrument, used with some variety in several arts. Engravers, etchers, cutters in wood, &c., use points to trace their designs on the copper, wood, stone, &c.

POINT-A-PITRE, a town in Guadeloupe, in the West Indies, on the south-west coast of the Grande-Terre, at the mouth of the Rivière-Salée, the strait which separates Guadeloupe proper or Grande-Terre from Basse-Terre. It has a spacious and secure harbour, defended by two forts and several batteries. It is one of the most important commercial towns of the Antilles. The principal exports are sugar, spirits of molasses, cocoa, cassia, raw hides, coffee, dyewoods, indigo, preserved fruits, tortoise-shells, rum, &c.; and the principal imports, woven fabrics, articles in leather, cod-fish, grain and flour, olive-oil, articles in metal, cattle, horses, wine, &c. The town was almost completely destroyed by fire in 1780, after which it was rebuilt in stone; but having been again destroyed by an earthquake in 1843, it was rebuilt in wood, and was again burned down in July, 1871. The want of water makes the town peculiarly liable to such calamities. Since the last fire the town has been rapidly rebuilt. Pop. 17,000.

POINT BLANK, originally the white spot in a target, at which an arrow or other missile is aimed. Hence, in gunnery, to fire point-blank, to fire at an object so near that the piece may be levelled in a straight line with it.

POINT-DE-GALLE, or simply **GALLE**, a fortified seaport town in Ceylon, on a peninsula on its south coast, 21 miles west of Matura, and 66 miles s.s.e. of Colombo. The appearance of Galle from the sea is singularly beautiful and picturesque. To the right is the fort, with its old walls and fortifications jutting far into the sea. In the centre of the town, and rising above every surrounding object, are the two gable ends of the old church built by the Dutch. Further on is the quay, surrounded by multitudes of canoes, and on a height is a neat and beautiful Roman Catholic chapel, while close to the harbour is the native town and bridge, white, and shaded by numerous trees, the whole backed by verdant hills clothed to the summit with woods, and the most luxuriant vegetation. The more distant hills assume a purple hue, and far in the rear rises the lofty summit of Adam's Peak, 7420 feet high. The fort is more than a mile in circumference, commanding the whole of the harbour, but in its turn commanded by a range of hills about 700 yards distant. Outside the town is a Buddhist temple with colossal figures upon it. The trade of Galle chiefly consists in coir rope, cocoa-nut oil, arrack, chaya root, coffee, cotton, rice, ivory, cinnamon, and tortoise-shell. The entrance to the bay is about a mile wide, the soundings in it from $7\frac{1}{2}$ to $4\frac{1}{2}$ fathoms, but rendered somewhat intricate by sunken rocks. The outer road is spacious, and in the inner harbour ships may lie in perfect security in 5 or $5\frac{1}{2}$ fathoms abreast of the town, but only for four months in the year. Many vessels call here, and steamers often take in coals. Pop. (1891), 33,505; (1901), 37,326.

POINTER DOG, a variety of dogs, so named from their habit of suddenly stopping when in the neighbourhood of game, and 'pointing' with the head in the direction in which the prey or quarry lies. This faculty, peculiar to this breed of dogs, renders them invaluable to the sportsman in marking game. It is undoubtedly hereditary in the Pointers, although it as certainly becomes better developed under training. The Pointer, generally known under

the scientific appellation of *Canis avicularis*, would appear to be nearly related to the true Hounds. The term 'Spanish' Pointer, frequently employed, would seem to denote that Spain or Western Europe was the original habitat of these dogs. The Pointers are smooth short-haired dogs, generally marked black and white, like the fox-hound, but occasionally coloured altogether black. The acute sense of smell which guides these dogs in 'pointing' appears to be exerted notwithstanding the prevalence of other and even more powerful odours than the mere scent of game; and the dog, once having pointed, remains motionless, and restrains himself from the slightest movement calculated to disturb the game. These dogs have been known to stand 'pointing' for more than an hour at a time.

POINT OF SIGHT. See PERSPECTIVE.

POISON. A poison is any substance of which a small quantity taken into the stomach, mixed with the blood by wounds, inhaled through the lungs, or absorbed through the skin, or introduced into the body in any other way, can produce changes deleterious to the health, or destructive of life, by means not mechanical. Many poisons operate chemically, corroding the organic fibre, destroying the form and connection of the parts, irritating powerfully, and causing inflammation and mortification. To this class belong most mineral poisons. Irritant poisons include: 1. Many metallic oxides and salts, as arsenic, one of the most destructive poisons, of which a few grains produce fatal effects; many preparations of copper, as verdigris, or acetate of copper, and many paints; also very acid or salt articles of food or drink when cooked in copper vessels. Many preparations of quicksilver, as corrosive sublimate, red precipitate, &c., and some common preparations of antimony, should also be named here. 2. Strong mineral and vegetable acids, when introduced into the body in an undiluted state, as concentrated sulphuric acid or oil of vitriol, nitric acid or aquafortis, hydrochloric acid, &c. 3. Some plants contain an extremely powerful irritant substance, as the wolf's milk (*Euphorbium esula*), the *Daphne mezereum*, &c. 4. Of the animal kingdom, the *cantharides*, or *Spanish flies* as they are called, are an irritant poison. The operation of all these poisons is very expeditious; when they enter the stomach violent sickness is felt, incessant straining and vomiting take place, with most excruciating pains in the stomach and bowels, as if knives were driven through them; then follows inflammation, if relief be not speedily obtained, and this is succeeded by mortification. Other poisons operate more by a powerful action upon the nervous system, which they affect in a variety of ways. These are the narcotic or stupefying poisons, and belong for the most part to the vegetable kingdom. The type of these is opium, with its active principle morphia, and to the same class belong chloral hydrate, chloroform, henbane, hyoscyamus, calabar bean, belladonna and its active principle atropia, prussic acid, and many others. At first they produce a species of intoxication and excitement, subsequently deep stupor and sleep, from which the person is with difficulty aroused, slow laboured breathing, and cold clammy skin. Prussic acid is one of the most powerful and rapid of poisons, producing within a few seconds giddiness, rapid breathing, and irregular action of the heart; convulsions, insensibility, and paralysis speedily ensue. Bitter almonds contain ingredients converted into prussic acid when the almonds are chewed. So also do the kernels of other seeds. There are numerous other poisons which operate through the nervous system, in which, however, stupor and insensibility are not prominent, but in which violent convulsions are marked. Such are nux vomica and

its active principle strychnia. Many other vegetable substances unite the features, so far as the poisonous characters are concerned, of irritant or corrosive, and narcotic poisons, producing vomiting, &c., like the former kind, and stupor, unconsciousness, convulsions, or paralysis, like the latter. Such are croton-oil, colchicum, laburnum, and woody nightshade.

One must not omit to notice the poisonous gases, some of which, like nitrous and sulphurous fumes, are absolutely irrespirable, and produce respiratory spasms. Other gases are respirable but cause death, such as carbonic acid gas (choke damp), by acting on the nervous system like a narcotic poison; others, like carbon monoxide, form stable compounds with the blood and interfere with its functions. Carbonic acid gas is produced by breathing, and its presence in breathed air is one of the causes of the vitiation of the atmosphere of confined spaces. The Indians of South America, between the Amazon and the Orinoco, apply a very powerful poison, called the *wourali* poison, to the heads of the arrows with which they shoot their game. It destroys life very quickly, without injuring the flesh. The so-called *morbid poisons*, or *contagions*, do not belong to this class, and are *poisons* in a very different sense, as, for instance, the poison of hydrophobia. See **CONTAGION**.

Every substance is called an *antidote* which counteracts the effect of a poison, more especially the remedies which belong to each kind of poison respectively. Antidotes are as various as poisons. They sometimes protect the body against the operation of the poison, sometimes change this last in such a manner that it loses its injurious properties, and sometimes remove or remedy its violent results. Thus in cases of poisoning by acrid and corrosive substances, draughts of magnesia in water, chalk, whiting, plaster from the wall, soda and potash water are given to neutralize chemically the corrosive substance and so destroy its power to do harm; and for caustic potash and soda, weak acids, such as vinegar in water, and lemon juice, are given for the same purpose. Other bland substances are also given to protect the wall of the intestinal canal from the action of the irritant. Such bland substances are white of egg beat up in water, milk, gummy water, oil, gruel, &c. Other substances form chemical compounds with the poison in the stomach, which are insoluble, and so do not pass into the circulation. Thus egg albumin forms such an insoluble substance with mercurial substances and copper. Still another class of antidotes follow the poison into the body, and by producing exactly contrary effects tend to prevent the influence of the poison being exerted. These are the true antidotes, and are said to be *antagonistic* to the poison. Thus, belladonna and its active principle atropia are antagonistic to opium and morphia; chloral hydrate is to some extent antagonistic to strychnia, and *vice versa*.

The law as to the sale of poisons in Great Britain is contained in the Pharmacy Act of 1868 (81 and 32 Victoria, cap. cxxi.). It is there provided that no one is to sell poisons unless he is a pharmaceutical chemist or chemist and druggist, as defined in that act (see **CHEMISTS**), and then only in conformity to certain regulations. The substances to be considered as poisons are enumerated in the act, and divided into two classes, the sale of which is differently regulated. Those belonging to the first class are: arsenic and its preparations; prussic acid; cyanides of potassium and all metallic cyanides; strychnine and all poisonous vegetable alkaloids and their salts; aconite and its preparations; emetic tartar; corrosive sublimate; cantharides; savin and its oil; ergot of rye and its preparations. Those of the second class are: oxalic acid; chloroform; belladonna and its prepara-

stones; essential oil of almonds, unless deprived of its prussic acid; opium, and all preparations of opium and of poppies. With regard to the substances included in both classes, it is enacted that when sold either wholesale or retail, they must bear the special name of the article, and the name and address of the seller, and be labelled 'poison.' Exception is made, however, in the case of articles exported from Great Britain by wholesale traders; or supplied wholesale to retail dealers in the ordinary way of business, which do not require to have the name and address of the seller affixed to them. With regard to the articles enumerated in the first class, it is enacted in addition that they shall not be sold to any person unknown to the seller, unless introduced by some person who is known to him, that the sale of any of these articles shall be entered in a book stating, in a form provided by a schedule, the date of sale, the name and address of purchaser, the name and quantity of the article sold, and the purpose for which it is stated by the purchaser to be required, and that this entry shall be signed by the purchaser, and if he has been introduced by any one, also by his introducer. Exporters and wholesale dealers supplying retail dealers are excepted also from these provisions; and with regard to medicines containing in them any of the substances in the first class, and supplied to patients by legally-qualified apothecaries, all that is required is that the medicine shall be properly labelled, and that the ingredients of which it is composed shall be entered in a book along with the name and address of the person to whom it is sold or delivered. Before the passing of the Pharmacy Act of 1868, the only poisonous substance, the sale of which was regulated by statute, was arsenic, with reference to which an act was passed in 1851 (14 and 15 Victoria, cap. xlii.). The Pharmacy Act of 1868 preserves this act intact, but the only provision contained in it, and not contained also in the Pharmacy Act, is one requiring the arsenic to be mixed with soot or indigo in the proportion of 1 oz. of soot or $\frac{1}{4}$ oz. of indigo to a pound, except when the quantity sold exceeds 10 lbs., in which case it may be sold unmixed, provided the purchaser states that it is not to be used for agriculture, and that his purpose could not be served if the arsenic were mixed with the substances mentioned.

POISONING. The use of poisons as means to get rid of an enemy or rival, or even of any person standing in one's way, is always exemplified in the records of crime, but there have been periods in the history of various countries when the practice was peculiarly prevalent. The motives for resorting to this method of taking life are obvious: the facility with which some poisons may be administered without even leading to the suspicion of violence, and the difficulty of proving the fact of poisons having been used even when suspicion has been aroused. This difficulty, however, existed only in times previous to the great advance which has been made in chemical knowledge, and was in a certain way compensated by the inordinate tendency to suspicion that was developed at certain epochs, and which has frequently attributed to poison the deaths of kings and others of the great, who, we have every reason to believe, died in a perfectly natural manner. The practice of poisoning was particularly common at Rome, and other cities of Italy, in the first century of our era. In the reigns of Claudius and Nero a woman named Locusta was notorious as a poisoner, and was said to possess the art of concocting poisons to act with any required degree of slowness or rapidity. About twenty or thirty years later Juvenal describes the practice as still raging in the city, and causing all those who were rich enough for their possessions to be coveted by their heirs to tremble. A further

proof of the generality of the use of poison in those days (whether for administering to one's self or to others) is to be found in the rings which have been discovered in the ruins of Pompeii, the majority of which contain large cavities intended, as we know or may reasonably infer from contemporary writers, for the reception of poison. The art which was so common in ancient Italy was perfected in modern Italy in the sixteenth and seventeenth centuries. One of the most subtle poisons invented in that country was the *argus tofana*, so called from a woman named Toffania, who compounded it, and who was put to death by strangling in 1719, after she had caused the death of upwards of 600 persons. It was still employed at the commencement of the nineteenth century, and the secret of its composition is perhaps, not lost even yet. It was an inodorous and colourless fluid, one drop of which, administered every week, caused the death of a person at the end of two years, if he were attacked by no malady in the meantime, and rendered every kind of malady, however otherwise unimportant, certainly fatal. It was thus remarkably well calculated to avert suspicion, since many of those whose death was really due to it had all the appearance of having been carried off by a natural death. But not only were the most subtle poisons devised, the most ingenious means of applying them were also invented. Thus a peach might be cut in two with a gold knife, poisoned on one side but not on the other. The person who ate the one half died, while the poisoner might eat the other unharmed. A prince of the name of Savelli is said to have possessed a key, on the handle of which was a small point which could scarcely be noticed, but which was rubbed with a certain poison, the action of which on the blood was sure and rapid. Whenever the prince wished to rid himself of any member of his court he would give him this key and bid him bring something from a drawer which it opened, in doing which the person using the key inevitably scratched himself with the projecting point on the handle, and the poison was thus introduced into his system. From Italy the practice and the art of poisoning spread to other countries, but flourished nowhere more than in France. The second half of the reign of Louis XIV. has abundant cases of poisoning to show, in most of which the nobility and sometimes the nobility of the court were mixed up. The young nobles attracted to Versailles by Louis dissipated their fortunes in all sorts of gaieties and debaucheries, and when they had done so their only resources for recovering themselves were gaming and intriguing for lucrative sinecures. When both of these failed other methods were adopted, and hence the introduction of the ancient Roman practice of heirs using poison to make away with those who kept them from their inheritances, from which arose the name of 'succession powder,' which was given to the preparation used for the purpose. At this period there were well-known houses where assignations might be kept and accouchements take place in secret, and the keepers of these houses added to their occupations that of furnishing means for removing husbands that their wives were tired of, rivals in quest of places, rich relatives, &c. Their trade flourished; they themselves occupied fine houses, rode in carriages, and were attended by numerous servants. For a long time the parliament of Paris turned a deaf ear to the demands of the people that these persons should be brought to justice. At last the case of Madame de Brinvilliers made it impossible for action to be delayed any longer. After her trial and execution things went on as before, till other three skilful and wealthy female poisoners, La Voisin, La Vigouroux, La Filastie, and two

priests, Lesage and Guilbourg, were arrested. During their examination it transpired that they had among their clients persons of both sexes of the highest rank, and the judges were afraid to proceed. Louis XIV. himself grew alarmed at finding how high in station some of those implicated in the charges brought against the poisoners were, and therefore took the case out of the hands of the parliament altogether, and intrusted it to a commission, called the *Chambre Ardente*, composed of members whom he could trust to make no indiscreet revelations. The guilty persons belonging to the court made their escape across the frontiers as quickly as possible. Since that time the practice of poisoning does not appear again to have become a general one among any class in France. There does not seem to be any evidence of the prevalence of the practice at any time in England to any extraordinary extent, although the cases of murder in this, as in all other countries, always contain a certain proportion in which poison was the means used by the murderer.

POISSON, SIMÉON DENIS, one of the greatest of modern French mathematicians, born in 1781 at Pithiviers, in the department of Loiret, entered the *École Polytechnique* in 1798. After quitting it he became a member of the *Bureau des Longitudes*, a professor in the Faculty of Sciences at Paris and in the *École Polytechnique*, and in 1812 was admitted into the *Institute*. Napoleon, to whom he was a steady adherent, made him a noble, and conferred many favours on him. He also gave in his adhesion to the succeeding governments. In 1820 he was appointed a member of the council of the university, and in 1837 was called to the Chamber of Peers by Louis Philippe. He died in 1840. He was indefatigable in his scientific labours, and yet, with the exception of his *Traité de Mécanique*, which forms a kind of era in the history of that branch of science, he has only produced a great number of separate papers, almost always of the greatest value, on electricity, magnetism, heat, the calculation of probabilities, the analysis of infinities, and other mathematical and physical subjects. The papers are scattered in the *Memoirs of the Academy*, the *Journal de l'École Polytechnique*, the *Journal des Mathématiques*, the *Annales de Chimie et de Physique*, and other collections.

POISSY (Latin, *Pissiacum*), a town in France, in the department of Seine-et-Oise, on the left bank of the Seine, 11 miles south-west of Versailles. It is a very dirty place, but its weekly cattle market, chiefly for the supply of the capital, is said to be the largest in France; and the town itself possesses considerable historical interest from the famous conference or colloquy, held in 1561, which bears its name, and in which the differences between Roman Catholicism and Protestantism were discussed at great length, but, as might have been anticipated, with no decisive result. Among the attendants were Charles X. and Catherine de Médicis; the principal debaters were Theodore Beza and the Papal legate Ippolito d'Este. Pop. (1896), 5313.

POITIERS (formerly spelled POIOTIERS), a town of France, the former capital of the province of Poitou, at present of the department of Vienne, 61 miles south-west of Tours. It stands mainly on an eminence at the junction of the Clain with the Boivre, and still retains its old walls and towers. It is not well built, but is picturesque and interesting. The space occupied is larger than the population requires, and is partly laid out in gardens, promenades, &c. The principal edifice is the cathedral, founded by Henry II. of England about 1162, and built in a style exhibiting the transition from the Romanesque to the Gothic. The exterior is rather plain, but it has

an imposing interior. Other ecclesiastical buildings include the ancient Church of St. John, originally a baptistery; the Church of St. Radegunda, the patroness of the town, with a crypt containing her tomb; besides other buildings. The modern town-hall, the law-courts, occupying the palace of the former counts of Poitou, the museum, the library and university building, also deserve notice. There are some interesting Roman and old Gaulish remains. The manufactures are not of much importance. Poitiers is a very old place, and is historically celebrated for two battles fought in its vicinity, that in which Charles Martel defeated the Saracen army under Abderrahman (October 18, 732), and that between the French under their king John II. and the English under Edward the Black Prince (September 19, 1356). The English army did not exceed 12,000 men; the French was not less than 60,000; but the English were superior in discipline and subordination, and occupied a more favourable position. The French van was at once routed, and their centre was broken almost at the first onset. John was made prisoner after an obstinate resistance, and though treated with great courtesy by the conqueror, was detained prisoner in London for four years, and obliged to purchase his freedom by the cession of several provinces and the payment of 3,000,000 crowns of gold. Pop. in 1881, 29,304; in 1901, 39,565.

POITIERS, DIANA OF. See DIANA OF POITIERS. POITOU, or POICROU, before the revolution one of the provinces of France, in the western part of the kingdom, between Brittany and Anjou on the north, Berry on the east, the Atlantic on the west, and Angoumois and Saintonge on the south. The departments of Vienne, Deux-Sèvres, and Vendée have been formed out of this province. This district was anciently inhabited by a tribe called Pictavi, from whose name that of Poitou is derived. Henry II. of England acquired possession of Poitou by his marriage with Eleanor, heiress of the last Duke of Aquitaine. Philip Augustus conquered it. It was ceded to the English by the Peace of Bretigny (1360), but was recovered by Charles V. See FRANCE—History.

POLA (*Pietas Julia*), a seaport town of Austria, in the peninsula of Istria, 55 miles south of Trieste, a fortress of the first rank, and the chief station of the Austro-Hungarian navy. It is an ancient place, and was for a lengthened period the principal town of Istria. It had, however, sunk to the level of a mere fishing-village when the Austrian government, understanding its excellent capabilities, selected it as their chief naval station, and by the construction of dockyards, an arsenal, barracks, and other government establishments infused new life into it. The entrance to the harbour is narrow, but the water is deep, and within it expands into a large basin, landlocked and safe. Forts and batteries on hills forming the background protect the harbour. Among ancient remains here there are the ruins of an amphitheatre, estimated to have been large enough to accommodate 18,000 persons; there are also two temples, one of which is in good preservation, very elegant in design and execution. Pola was most flourishing in the reign of Severus, when it is said to have had a population of 30,000. A triumphal arch, erected by Salvia Posthuma in honour of her husband Sergius Lepidus, is in a pretty good condition, and under the name of Porta Aurea is used as a gate of the town. The principal modern edifice is the cathedral, which dates from the ninth century. Pop. (1880), 25,173; (1890), 30,714; (1900), 45,052.

POLACCA. See POLONAISE.

POLACCA, or POLACRE, a vessel used in the Mediterranean. The masts are usually three in

number, and consist of only one spar, so that they have neither tops nor cross-trees. They are usually rigged with square sails.

POLAND (Polish, *Polska*, meaning 'Flat Land'; Latin, *Polonia* and *Sarmatia*), an extensive territory of Central Europe, which existed for many centuries as an independent and powerful state; but having fallen a prey to internal dissensions, was violently seized by Austria, Prussia, and Russia as a common spoil, partitioned among these three powers, and incorporated with their dominions. In its greatest prosperity it had at least 11,000,000 of inhabitants, and an area of 350,000 square miles, and immediately before its first partition an area of about 282,000 square miles, stretching from the frontiers of Hungary and Turkey to the Baltic, and from Germany far east into Russia; lat. 47° to 56° N.; lon. 15° to 32° E. The territory thus bounded formed one vast and remarkably compact kingdom, divided into Great and Little Poland on the west; Masovia and Podlachia in the centre; Volhynia, Podolia, and the Ukraine in the east; and Lithuania in the north-east. The principal subdivision was into thirty-one palatinates and starostys. These territories correspond to the modern governments of Kovno, Vitebsk, Mogilev, Vilna, Grodno, Minsk, Kiev, Podolia, Volhynia, Kalish, Kjeletz, Lomsha, Lublin, Piotrkov, Plock, Radom, Siedletz, Suwalki, and Warsaw in Russia; the provinces of Prussia and Posen, and the Pomeranian government of Köslin in Prussia; and the Kingdom of Galicia in Austria. The last ten of the Russian governments mentioned constitute what was handed over to Russia by the Congress of Vienna in 1815 as the Kingdom of Poland, and what are now known as the governments of the Vistula.

The most characteristic feature of the surface is its uniformity. With exception of the Carpathians, forming its south-western boundary, and a ridge of moderate elevation penetrating into it from Silesia, it scarcely possesses a single summit deserving the name of hill, but is truly, as its name implies, 'flat land,' presenting the appearance of an almost unbroken plain, composed partly of gently-waving slopes, partly of rich alluvial flats, partly of sandy tracts so barren as to deserve the name of deserts, and partly of extensive morasses. The last, contrary to the general rule, occupy the most elevated part of the interior, and consist of a broad belt curving irregularly in a north-eastern direction from the Hungarian frontiers into Lithuania, and though only from 400 to 500 feet above sea-level, forming part of the great European water-shed, the waters on the one side of it flowing north to the Baltic, while those on the other side flow south to the Black Sea. Its principal streams are the Vistula, with its tributaries Wieprz and Narew; the Warta and Proсна (tributaries of the Oder), the Niemen, and the Dvina, all belonging to the basin of the Baltic; and the Dniester, South Bug, and Dnieper, with its tributary Pripiet, belonging to the basin of the Black Sea. The physical configuration of the country makes it admirably adapted for the operations of agriculture, and the fertility of its alluvial tracts is so great that it has sometimes been termed the granary of Europe. As yet, however, its productive powers have never been fairly tested; and its exports of grain, though large, are probably not a tithe of what they might be under more favourable circumstances. Next to grain and cattle its most important product is timber, which in several quarters forms large and splendid forests. The minerals include the precious metals in limited quantity, iron in sufficient quantity, but of indifferent quality; and salt, chiefly in Galicia, where its mines have long been worked on a very extensive scale, and are to all appearance inexhaustible. Owing to

the inland situation of the greater part of the country, and more especially to the cold winds which blow from Russia on the east, and from the Carpathians on the south, the winter of Poland is almost as severe as that of Sweden. The summer is abundantly warm, but the general humidity of the atmosphere and the miasma of the marshes, conjoined with a common neglect of cleanliness and other sanitary precautions, make disease sometimes, under peculiar forms, very prevalent. Little progress has been made either in manufactures or trade, the former being chiefly confined to articles of primary necessity, particularly coarse woollen and linen cloth, for the weaving of which almost every family is provided with its domestic loom; and the latter, which is mostly in the hands of the Jews, who are more numerous in Poland than in any other part of Europe, being seldom on an extensive scale, though including the retail of an almost endless variety of objects. For more detailed information regarding the soil, climate, and productions of Poland, see the articles on the modern governments and provinces mentioned above, into which it has been divided.

The Poles are a Slavonic race, possessing fine physical forms, and are strong, active, ardent, and daring. Unfortunately, however, these original qualities of the race, though preserved to a great extent by the privileged classes of the nobility and gentry, whose birthright secured them in the possession of personal freedom, have greatly degenerated in the mass of the people, who till recently were degraded to mere serfs, and had sunk to the level of their condition. The prevailing religion of the Poles is Roman Catholic, though it has not been permitted to retain its ascendancy without a struggle. The Reformation early took deep root in the country, and made such rapid progress that bigotry took alarm, and repressed it by lighting the fires of persecution. Since the Russians became masters they have laboured incessantly and systematically to introduce their own religious system, and with a success which seems to intimate that the religious convictions of the inhabitants are held by a feeble tenure, and easily yield to the suggestions of interest. With similar zeal and perseverance the Russians are aiming at the extirpation of the Polish tongue by discouraging the cultivation of it, and not only introducing Russian into the public schools, but making the knowledge of it an essential requisite for office. Among the numerous degradations to which foreign domination subjects the Poles, there is none to which they appear more sensible than this attempt to complete their national destruction by the extirpation of their native tongue.

History.—At a very early period—it cannot now be ascertained how early—all the regions to which the name of Poland was subsequently extended were inhabited by Slavonic tribes, the most civilized of whom, in the ninth century of our era, when the light of history begins to be faintly shed on them, were those occupying the fruitful plains on the Vistula, and called by the Russian chroniclers *Lachas*, and by the Polish *Leches*. In the course of time either this people as a whole or a division of them came to be called Poles, that is, 'Slavonians of the plain,' and these Poles ultimately obtained preponderance over the neighbouring tribes, and their name became common to a wider circle of peoples than that to which it was first applied. Like all the Slavonic nations the Poles were originally divided into small communities, and it was long before they became united into a political whole and obtained an important place in history. The earliest princes mentioned in the legendary history of Poland are Lech and the princes of the families of Lemsek and Popiel.

After the death of the last prince of the latter family the Poles are said to have elected a prince of the name of Piast (about 842), with whose son Ziemowit the legend acquires greater definiteness. The fourth or fifth of the Piast dynasty, Duke Miescyslaw I., in 964 married Dombrowka, daughter of the Duke of Bohemia, and adopting Christianity founded the first Polish bishopric at Posen. In the previous year he had been compelled by the margrave Gero to acknowledge the supremacy of the German emperor Otto I. and to hold his land as a fief. But this relation of dependence was dissolved under his son Boleslaw I., Chrobry, or the Great, who reigned from 992 to 1025, and was the true founder of the Kingdom of Poland. He united under his sway all the Polish tribes, conquered Danzig and Pomerelia (the western part of West Prussia), Silesia, Lausatia, and Moravia, and on the east advanced as far as Kiev. Bohemia also was for a time under his rule, but was soon lost. His dominions are said to have extended from the Saale to the Dnieper and from the Danube to the Baltic. In the year 1000 Boleslaw received the visit of the Emperor Otto III., on which occasion the Polish archbishopric of Gnesen was founded, and in 1024 he received the crown of Poland in fief from the pope. After his death, however, his kingdom became a prey to internal wars of long duration, and by repeated subdivisions at last completely fell to pieces. The conquered countries recovered their independence. Silesia became a separate kingdom under a collateral branch of the Piast dynasty. The numerous Polish princes were, besides, continually involved in wars with their neighbours the Germans, Russians, Lithuanians, and Prussians. At last Konrad, duke of Masovia, one of the Polish duchies which had been formed out of the dominions of Boleslaw, called in the aid of the Teutonic order of knights against the Prussians, and these, between 1230 and 1404, conquered the whole of the Baltic seaboard from the Oder to the Gulf of Finland. The first king under whom Poland again acquired importance was Ladislaw Lokietek. He inherited the throne of Cracow in 1295, but as the Poles were dissatisfied with him they elected in his place Wenceslaw II., king of Bohemia, who ruled over Poland (or at least over part of it) from 1300 to 1305. In the latter year Lokietek recovered the throne by the sword, and afterwards united under his sway both Great Poland on the Warta and Little Poland on the Upper Vistula. His reign lasted till 1333, when he was succeeded by his son, Casimir III., who, on account of his wisdom as a legislator, and his exertions in civilizing the interior, was surnamed the Great. In order to secure a solid basis for the future greatness of his country he determined, if possible, to remain at peace with his neighbours. With this view he concluded in 1343 the Treaty of Kalisz with the Teutonic order, to which he formally ceded the Oder and the Lower Vistula, of which it was already in actual possession. He fortified the towns and freed them from the oppressions of the nobility, and by his other measures gave a great impetus to the national prosperity. With Casimir the male line of the Piasts was destined to become extinct. The nobility, to whom Ladislaw in 1331 had granted the right of assembling in a diet, now began to barter their votes with the candidates for the throne in exchange for personal privileges, which could be granted them only at the expense of the general body of the people. Casimir died in 1370, and was succeeded by his sister's son, Louis of Hungary, with which kingdom Poland was united till the death of Louis in 1382. Louis's daughter, Hedwig, was now elected Queen of Poland, and although Ladislaw, a cousin of Casimir III., obtained

permission from the pope to seize the crown, she was successful in making good her title. In 1386 she gave her hand to Jagellon, grand-duke of Lithuania, who embraced Christianity, was baptized under the name of Ladislaw (II.), and united his grand-duchy to the crown of Poland. After the death of Hedwig, in 1399, he was about to return to his own country; but the Poles, convinced of the advantages derived from the union with Lithuania, maintained him upon the throne, and he thus became the founder of a Polish dynasty which lasted till 1572, and which includes the following seven kings:—Ladislaw II. (Jagellon), 1386–1434; Ladislaw III., 1434–44; after an interregnum of two years Casimir IV., 1446–92; John I. (Albert), 1492–1501; Alexander, 1501–6; Sigismund I., 1506–46; and Sigismund II., 1546–72. Under this dynasty Poland gained in power and extent. The Lithuanians and Poles combined were more powerful against their common enemy the Teutonic knights, who were compelled in 1466 to agree to the Treaty of Thorn, by which they ceded to Poland West Prussia and Ermeland, and recognized the suzerainty of Poland over East Prussia, which in 1525, with the sanction of Poland, was erected by the grand-master, Albert of Brandenburg, into a hereditary duchy. In 1526 the family of Piasts reigning in Masovia became extinct, and the duchy was united to Poland. In 1561, under Sigismund II., the Knights of the Sword, an order in Livonia similar to the Teutonic order, having appealed to the Poles for help against the Turks, agreed to a treaty with the Poles by which the order was secularized and Livonia annexed to Poland, while the master of the order received Courland as a Polish fief by way of compensation. The power of Poland was still further increased in the same reign in 1569, when the union of Poland and Lithuania was consummated by the admission of the Lithuanian nobles into the Polish diet. On this occasion Warsaw, a town situated in the duchy of Masovia, and thus neither Polish nor Lithuanian, was fixed upon as the place where the common diet should meet. The principal internal change which took place in Poland was the organization of representative diets. The system of representative diets dates in Poland from the year 1468. Till then they had been summoned to meet at the king's pleasure, and had no regular form, but from that year the diets met regularly, and were attended by two nuncios (*nuntii terrestres*) from each district into which the kingdom was divided. These nuncios were required to receive precise instructions from their constituents, and were not allowed to go beyond them. The diets also included representatives from the towns. This arrangement put for a time the chief power into the hands of the great body of the people; but it did not continue long in force. The nobles gradually succeeded in banishing the representatives of the towns and in regaining all their former influence; so that by the end of the reign of Sigismund I. almost all the guarantees for the liberty of the people had been done away with.

After the extinction of the Jagellon dynasty in 1572 Poland became in fact what it had been in principle ever since the election of Louis of Hungary as king, an elective monarchy. Henry of Valois, afterwards Henry III. of France, was the first of the new series of monarchs. He was elected in 1573, and in 1574 swore to the first *Pacta conventa*, a body of fundamental laws of the constitution, which all subsequent kings were bound by an oath to respect. These consisted in the main of privileges granted to the nobility, but included a provision for guaranteeing complete religious liberty to all sects. This provision was made with the object of securing

peace between the Roman Catholics, who formed the main body of the people, and the Dissidents, consisting of members of the Greek and Armenian Churches, but chiefly of the adherents of different sects of Protestantism, which had made great progress in Poland. When Henry, after a reign of four months, secretly made his escape in order to take possession of the throne of France, Stephen Bathori was in 1575 elected to succeed him. While he reigned there was once more a strong government in Poland. Internally the country was comparatively tranquil, and externally its arms were victorious. The provinces which had been seized from Poland by the Czar of Muscovy were recovered. After his death in 1586 a Swedish prince was elected under the title of Sigismund III. Those who brought about this election had done so with the hope of uniting Sweden and Poland, but Sweden soon broke away from the union, and in consequence of this a war ensued between the two countries, which was not finally concluded till the Peace of Oliva in 1660, in which Poland lost Livonia and Esthonia, and was deprived of the suzerainty over East Prussia. Meanwhile Sigismund III. had died in 1632, and had been succeeded by Ladislaw IV. (1632-48), and John II. Casimir (1648-69). Under the last-mentioned king the political condition of Poland became so completely anarchical that the free veto by which the vote of a single deputy of the diet might negative a proposal in which all the others were agreed was made legal. One great cause of the anarchy which prevailed was the decline in strength of the Dissidents, and their consequent loss of political privileges. Since the reign of Sigismund III. a reaction against the Protestantizing tendency had been in progress, partly in consequence of the efforts of the Jesuits, and partly of the quarrels among the Dissidents themselves. Very many Protestant converts, especially among the leading families of the country, returned to their old faith; and between 1606 and 1620 the Dissidents lost two-thirds of their churches. The Roman Catholics, who now felt their power, began to abridge the privileges which had been frequently confirmed to them, and even to subject them to persecution in violation of the law. Religious and political oppression occasioned the revolt of the Cossacks, who in 1654 placed themselves under the protection of Russia, and in 1667 Smolenak, Kiev, and the land east of the Dnieper were surrendered to the same power. After the abdication of John Casimir the lower nobility effected the election of Michael Wisniowiecki, who reigned from 1669 to 1674. His successor, the brave John Sobieski (1674-96), in the Peace of 1686, confirmed the cessions which had been made to Russia under John Casimir. After his death the throne appeared to be at the disposal of the one who offered most. The Abbé Polignac, on behalf of Louis XIV. of France, sacrificed large sums in order to determine the choice in favour of the Prince Conti. When the Elector of Saxony, Augustus II., had managed to secure his election to the throne in opposition to the French party (1697), he allied himself with Peter the Great of Russia in an attempt to recover Livonia from Sweden, and Poland thus became involved in the Northern war. After the victories of the Swedes the Polish diet, which was tolerably indifferent to the fate of their elective king, deposed him (Feb. 14, 1704), and a few months later elected Stanislaw Leszczynski in his room. Stanislaw continued to hold the throne of Poland as long as the Swedish arms remained in the ascendant; but in 1709, after the defeat of Charles XII. at Pultava, Augustus of Saxony was restored and maintained in possession of the throne till his death in 1733. When this event took place Stanis-

law Leszczynski, whose daughter had just been married to Louis XV., with the support of the French, made another effort to regain the throne of Poland, but Austria and Russia were determined to have no ally of France for their neighbour, and induced the principal nobles and prelates of Poland to proclaim Augustus III. of Saxony king, although the people generally were favourable to the pretensions of Stanislaw. The confusion in the country was now greater than ever. In 1717 and 1718, under the reign of Augustus II., the rights of the Dissidents had been still further curtailed, and in 1733 they were formally excluded from all public offices. The most violent passions were thus inflamed in all classes of the people. After the death of Augustus III. in 1763, and the election of Count Stanislaw Augustus Poniatowski in 1764 as his successor, the Dissidents, supported by Russia, Denmark, Prussia, and England, endeavoured at the diet of 1766 to obtain a remedy for their grievances; but although in 1767 a treaty was concluded at the instance of Russia, by which they were restored to a footing of complete equality with the Catholics, the fanatical opposition made to these proceedings by Bishop Soltyk of Cracow and Massalski of Vilna brought about a civil war which plunged the land into the wildest confusion, and caused Catharine II. of Russia to say that Poland was a country into which the three neighbouring great powers had only to lay their hands in order to take out something. Russia took it upon herself to defend the cause of the Dissidents, and in order to resist her influence a confederation was formed in Feb. 1768 at Bar, then a Polish town, but now in the Russian government of Podolia. In these circumstances it appeared to the Austrian court opportune to resume the county of Zipa, which had been pledged by Hungary to Poland early in the fifteenth century. By this act it gave Russia and Prussia, the two other great powers contiguous to Poland, a welcome pretext for carrying into effect the long-meditated partition of that country. On the 5th of August, 1772, the three powers concluded a treaty among themselves with that object, and on the 18th of September, 1773, Poland was compelled to give its consent to the first partition, which had already actually taken place, and by which it lost 85,000 square miles. The acquisitions of Austria, which included most of the territories which now form the Kingdom of Galicia, amounted in all to 27,000 square miles. Those of Prussia, the principal of which was Polish Prussia, with the exception of Danzig and Thorn, had an area of 18,415 square miles. And those of Russia, which included, among other districts, Livonia, amounted to nearly 42,000 square miles. What remained to Poland was completely under Russian influence. A patriotic party now began to labour for the restoration of Poland to its former position, and under the impression caused by the revolutionary proceedings in France a reform of the constitution was projected, according to which the elective monarchy and the free veto were to be abolished, and the third estate to be received into the national representation. A new constitution, dated the 3d of May, 1791, was actually framed on these principles, and received the approbation of Prussia. Russia, however, rejected it, and espoused the cause of its opponents, a small section of the nobility, who had on the 14th of May, 1792, concluded at Targowicz a confederation against it. Prussia now abandoned the cause of the republic, and on the 4th of January, 1793, consented to a second partition, by which Russia received nearly 97,000 square miles (including, among other territories, the crown domains of Polish Ukraine and Podolia, and the eastern half of Volhynia), and Prussia 22,500

square miles (consisting mainly of the parts now forming the province of Posen, besides Danzig and Thorn). Russian bayonets compelled the indignant members of the diet to acquiesce in this new dismemberment of their country. The heroic Kosciusko in this situation of affairs became the head of the confederation which was formed at Cracow in March, 1794, for the defence of their country. The battle of Racławice, April 4, 1794, and the relief of Warsaw, which was besieged by the Prussian army, September 5 and 6, 1794, are the most glorious days in the history of the Polish nation. But it was too late. Without fortresses, discipline, allies, or even arms; surrounded by Russians, Prussians, and Austrians, the Poles could not but succumb in the end. After the defeat and capture of Kosciusko at Maczewice on the 10th of October, and the fall of Praga, a suburb of Warsaw, on the 4th of November, further resistance was hopeless. The third and complete partition of the country was now agreed upon between Russia, Prussia, and Austria (Jan. 1795), and the mode of dividing the spoil fixed by a triple treaty, signed at St. Petersburg on the 24th of October, 1795. Russia received in all 48,000 square miles (including the duchy of Courland, a Polish fief, the duchy of Semigallia, &c.); Prussia, 21,200 square miles (which included that part of the duchy of Masovia in which Warsaw was situated); and Austria, 17,700 square miles (including the town and the greater part of the Palatinate of Cracow, and other portions). The last king, Stanislaw Augustus, was compelled on the 25th of November, 1795, to sign his own abdication, and to spend the remainder of his days in Russia in the receipt of a pension. He died at St. Petersburg in 1798. To the Poles nothing remained but wounded feelings of national pride, a bitter hate against Russians and Germans, and fruitless appeals to French aid and public sympathy. In all Russia had robbed Poland of upwards of 180,000 square miles and 4,600,000 inhabitants; Austria, of about 45,000 square miles, with 5,000,000 inhabitants; Prussia, of 57,000 square miles, with 2,550,000 inhabitants.

The dismembered country, which now first received internal order from foreign hands, continued in this condition till November, 1806, when Napoleon's victories over Prussia led the emigrant Poles, under Dombrowski, to Posen and Warsaw. By the terms of the Peace of Tilsit (July 9, 1807) the greater part of the Prussian Polish provinces was formed into the duchy of Warsaw, which received a German ruler in the King of Saxony, and at the same time with the French code a constitution similar to the French, by which serfdom was abolished. In this duchy much was indeed done for the elevation of the masses, but the pressure of the war, conscription, and the continental system, prevented the growth of a sound state of prosperity. The Peace of Vienna (Oct. 1809) added West Galicia to the duchy of Warsaw, and the hope arose among the Poles, many of whom had nobly served Napoleon in his wars against Austria and in Spain, that he seriously intended to restore the national independence. How delusive this expectation was first appeared in the campaign of 1812, when it was manifest that all that Napoleon desired was to raise as many troops as possible in the country. The disastrous termination of this campaign brought the duchy to a speedy end. Its administration was at once assumed by Russia, and the congress at Vienna (in 1814-15) decided the fate of the country. 1. The city of Cracow, with its territory (466 square miles), was to be governed by its own laws, as a free and independent republic (see Cracow); 2, the country on the right bank of the Vistula, with the circle of Tarnopol, which had been ceded

to Russia by the Peace of Vienna, was restored to Austria; 3, the circles of Kulm and Micheland, the city of Thorn and its territory, the department of Posen, with the exception of the circles of Powitz and Peysern, and part of the department of Kalisz, as far as the Prozna, excluding the city and circle of that name (these limits were more exactly defined by the boundary-treaty between Russia and Prussia of Nov. 11, 1817), were ceded to the King of Prussia, who united Danzig, Thorn, Kulm, and Micheland with West Prussia, and from the remainder formed the grand-duchy of Posen; 4, all the rest was united with the Russian Empire under the name of the Kingdom of Poland, but with a separate administration, and such a territorial extent as the Russian emperor should see fit. The Emperor Alexander, therefore, assumed the title of Czar and King of Poland, and received homage in Warsaw. Poland, though thus divided, preserved its name and language, as the treaties of Vienna secured to all Poles who were subjects of any of the three powers such an organization as tended to maintain their national existence. A Polish charter was accordingly promulgated (Nov. 27, 1815), consisting of 165 articles, which, if faithfully executed, would have promoted the welfare of Poland. The government of the country was to be vested in a native Pole, as lieutenant of the kingdom, unless one of the imperial princes should be appointed viceroy. This was rendered nugatory by the presence of the tyrannical Constantine as commander-in-chief. Equality of religious sects, personal security, liberty of the press, the entire possession of all employments, civil and military, in the country by Poles, were among the promises of the charter; and these rights were to be secured by a national diet composed of two chambers. But these promises were kept only to the ear; restrictions on the press, arbitrary imprisonment, arbitrary and cruel punishments, insults added to injuries, a solemn mockery of a diet, which was not allowed to exercise any real authority; the violation of every article of the charter by a Russian barbarian; speculation and extortion practised by the inferior officers—these were some of the features of the Russian government of Poland.

The first diet assembled in 1818, and the liberty of the press was abolished by an act of 1819. Another diet was held in 1820, but these meetings were rendered mere ceremonies; they had no freedom of debate, for those members who dared to express opinions unpalatable to the government were banished to their estates, and made to pay the troops that guarded them; it could not refuse supplies; and in 1825 an ordinance was issued by the government abolishing publicity of debate. The resources were squandered to maintain a Russian and Polish army, and Russian governors practised all sorts of extortion; state prisoners were sent into Russia, and imprisoned without trial; respectable citizens were flogged, or made to work in the highways without any charge being specified against them. On the death of Alexander (December, 1825) and the accession of Nicholas a conspiracy broke out in Russia, and, on pretence that it extended to Warsaw, several hundred persons were arrested in Poland, and a commission constituted, contrary to the provisions of the charter, to inquire into the affair. The only discovery of this inquisitorial tribunal, was that secret societies had existed in Poland since 1821. In 1828 a society was instituted for the purpose of gaining over the officers of the army to the cause of independence, and the insurrection of 1830 was the result of its plottings. It appears, nevertheless, that it was immediately occasioned by a sham conspiracy got up by the Russian police, who had thus induced a num-

her of young men to betray themselves, and crowded the prisons with the victims.

On the evening of the 29th of November, 1830, a young officer entered the military school at Warsaw, and called the youth to arms. They immediately proceeded to Belvidere, the residence of Constantine, about 2 miles from the city, for the purpose of seizing his person. They were joined on the way by the students of the university, and forced their way into the palace; but the prince was concealed in a clothes-press by a servant, until he could make his escape by a secret door. Another party of cadets and students paraded the streets calling the citizens to arms, and they were joined by the Polish troops. The arsenal was seized with 40,000 stand of arms, and the insurrection now became general. On the next morning 40,000 troops and citizens were in arms, and the Russians were expelled from Warsaw. The administrative council was summoned to preserve order, and several of the most distinguished Poles were invited to sit with it. On the 13th of December the prince was allowed to leave the neighbourhood of Warsaw with three regiments of Russian cavalry and two regiments of infantry without opposition. On the 25th of January, 1831, a diet, which had met on the 18th of December in the previous year, pronounced the deposition of the house of Romanov, declaring the throne of Poland to be vacant, and at the same time a government was organized under Adam Czartoryski. Thus far the insurrection was completely successful; but it ultimately failed, as well in consequence of want of unity among themselves, as of the superior strength of Russia. In the battles which took place under Chlopicki, Skrzynski, and Dwernicki, at Dobre, Stoczek, Grochow, and Ostrolenka, the Poles fought with boundless courage; but all their exertions were unable to prevent the Russian general Paskievich from advancing upon Warsaw. On the 8th of September, 1831, this city capitulated, after which the remnants of the Polish army either took refuge on Austrian or Prussian territory, or surrendered to the Russians. The final result of this insurrection was only to put the Poles more completely under the government of Russia. The constitution of 1815 was formally abolished, and replaced by the organic statute of February 14 (26), 1832. The Polish army was disbanded, a strong citadel was erected in Warsaw; the people were disarmed, and every effort was made to Russianize the country.

The Polish emigrants, however, did not yet give up hope, and from time to time tried to raise new revolts. Risings did actually take place in 1846, in the parts which had fallen to Austria, Prussia, and Cracow (which last then lost its independence), and in 1848 in Prussia alone, but all these attempts came to nothing. More serious troubles began in Russian Poland in 1860. A meeting at Warsaw of the sovereigns of Russia, Prussia, and Austria, which took place in the October of that year, recalled the memory of the partitions of Poland, and produced throughout the country an excitement which manifested itself in patriotic celebrations. Attempts were made to check this excitement by force; but afterwards Prince Gortchakoff, the governor in Poland, resorted to conciliatory measures, and allowed the Poles to prepare an address to the emperor, Alexander II., praying for the restoration of their national institutions. The emperor treated this address as seditious. Nevertheless by a ukase of the 26th of March, a council of state, formed of Poles, was created at Warsaw, elective councils were instituted in every government and district, and municipal councils at Warsaw and a number of the other principal towns. These concessions were, however, little more than nominal. When the statutes, ac-

ording to which the ukase was to be carried out, were promulgated, it was found that the governmental, district, and municipal councils had scarcely any functions assigned them. Their decisions might be cancelled by their presidents, whose appointment was in the hands of the government; and the council of state, the members of which were to be nominated by the emperor, was to deliberate with closed doors. The publication of these statutes increased the discontent, which spread from Warsaw throughout the kingdom, and even into the ancient Polish provinces, especially into Livonia, where a rising at Vilna was violently suppressed by the Russian government (August 18, 1861). During the next few months the agitation went on constantly increasing to a large extent, in consequence of the violent and impolitic measures of the Russians. At last the government essayed another step in the way of conciliation. On the 8th of June, 1862, the Grand-duke Constantine, brother of the emperor, was appointed lieutenant of the kingdom, and the Marquis Wielopolski was associated with him as head of the civil government, in which capacity he endeavoured to allay the discontent by furthering the material prosperity of the land. In this he might have succeeded had not he taken other steps which completely counteracted the good effect that his first efforts might have had, and even raised the discontent to a higher pitch than ever. Among other obnoxious acts he ordered a levy of conscripts to be made, a thing which had not been done since the Crimean war; and to make matters worse it was determined that the choice of the conscripts should not be left to lot, but should be in the power of the administration, which thus hoped to get rid of the most turbulent part of the population, and especially of those who had figured in the recent disorders. On the 15th of January, 1863, the recruitment took place at Warsaw by night, and the persons destined to serve in the army against their will were taken to the citadel. On the 22d day of the same month a general insurrection broke out at numerous different points. A central committee was formed at Warsaw to direct the movements of the insurgents. From the beginning of February fighting was going on everywhere. On the 10th of March Langiewicz, who had defeated the Russians at Pleskova-Scala five days previously, was appointed by the central committee dictator and general of all the insurgent armies; but on the 19th he was defeated and killed at Tagoscie, and his troops were obliged to save themselves by crossing the frontiers of Galicia. On the 17th of June the cabinets of England, France, and Austria addressed separate notes to the Russian government, urging it to grant the principal demands of the Poles; but this attempt at mediation failed; and the proposal of a European conference relative to the affairs of Poland, which was then made, was rejected by Prince Gortchakoff, the Russian minister (cousin of the Prince Gortchakoff formerly mentioned), as an unwarranted interference with the internal affairs of Russia. The war was now carried on without mercy, and with less and less prospect of success on the part of the insurgents. The Russians succeeded in exciting the peasants against their masters, and securing their aid. They first charged them with the duties of rural police, requiring them to watch the public roads and arrest suspected persons, and afterwards promised to those who should assist in pursuing the rebels part of the lands to be confiscated from the smaller nobility and the *bourgeoisie*. In March, 1864, the rising was completely quelled, but not till the insurgents had been terribly reduced in numbers. Many had been executed; thousands had fallen on the field of battle; thousands more had been banished to Siberia; and

after the suppression of the revolt a new band of Polish emigrants went to swell the number of those already scattered over foreign countries. In 1867 a limited amnesty was proclaimed in favour of those who had taken part in the insurrection.

Since 1864 the policy of Russia with regard to Poland has been directed to the complete assimilation of the two countries, but also to the improvement of the condition of the peasant class in the latter country. The measures adopted for this second purpose were, of course, to a large extent, meant as blows against refractory nobles. To measures of this class belong the ukase of November 11, 1866, abolishing (with compensation in the case of private owners) the servitudes, imposts, and monopolies with which 450 towns and villages of Poland were burdened, and that of June 24, 1870, to facilitate the conversion of tenancies of land into private property. The principal measures for the assimilation of Russia and Poland belong to the years 1867-69. In 1867 there was a new administrative division of Poland into ten governments and eighty-five circles; the financial arrangements of the country were brought into harmony with those of Russia; the Polish council of state was abolished; and the affairs of the Roman Catholic Church were subordinated to an ecclesiastical college in St. Petersburg, all direct intercourse between the pope and the Roman Catholic clergy being prohibited. In 1868 the administrative incorporation of Poland with Russia was completed by the ukase of March 12, which placed the officials of the Polish governments under the authority of the directing senate of the empire. The Viceroy or Lieutenant of Poland was left with merely nominal duties to discharge. In this year also even the name of Poland was officially dropped, and replaced by that of Governments of the Vistula. By a ukase of the 8th of July, 1869, the University of Warsaw was thoroughly Russianized, and about the same time it was decreed that Russian should be the sole language used in schools. From this time forth the history of Poland is completely identified with that of Russia.

An excellent work respecting Poland is Rulhière's *Histoire de l'Anarchie de Pologne et du Démembrement de cette République* (four vols. Paris, 1807). Respecting the first partition of Poland, see Von Dohm's *Denkwürdigkeiten* (one vol.), *Lettres du Baron de Vioménil* (Paris, 1808), and Malte Brun's *Tableau de la Pologne, ancienne et moderne*. See also Salvandy's *Hist. de Pologne, avant et sous J. Sobieski* (Paris, 1829); Fletcher's *History of Poland* (8vo, London, 1831); Lelewel's *Histoire de Pologne* (Paris, 1844); Chodzko's *Histoire populaire de Pologne* (Paris, 1862); Chevé's *Histoire complète de la Pologne* (Paris, 1863); and Morfill's *Poland* (in the *Story of the Nations* series; 1893).

Polish Language.—The uncertainty of the earliest Polish history spreads a deep obscurity over the rise and progress of the language. It is of Slavonic origin, and is more nearly allied to Bohemian than any other tongue. It differs very much from its eastern sister, the Russian language, in the number of its hard consonants. The cultivation of the language early met with a great obstacle on account of the adoption of Christianity, according to the Latin ritual; for the clergy, being the most cultivated order, took possession of the places of honour and the public offices, so that the Latin language became the language of the state, and afterwards, on account of the kings and queens being foreigners, the language of the court, and of all the educated classes also. The language of the country first recovered its rights in the reign of Sigismund, in the sixteenth century, and became in the middle of that century the language of books; it then declined in the seventeenth,

but flourished again during the reign of Stanislaw Augustus, and ripened to a maturity of which even the subsequent political changes could not entirely deprive it. In 1801 a society for the preservation of the purity of the Polish language was formed at Warsaw, under the direction of the Bishop Abbertrandi, and in 1802 published the first volume of their transactions. The Russians are now making every effort to supplant it by their own language.

The Polish language is above all things remarkable for its phonetic richness. It contains nine vowels, the sound of *y* (which is represented by *j*), and thirty-five consonants. The alphabet used is the Latin, diacritic marks and combinations being used where that alphabet is defective. The number of these marks and combinations makes the Polish language as spelled appear much harsher in the eyes of a foreigner than it is in reality. The Polish language is indeed said to be the very reverse of harsh, and the most harmonious of the Slavonic tongues. The pronunciation is indeed difficult to a foreigner, but this is solely due to the nice gradations by which the sounds are distinguished. The principal peculiarities of its pronunciation are the following: *c* is pronounced like *ts* in English; *ch* is a strong aspirate, as in German; *cz* is pronounced like *ch* in church; *g* is always hard, as in give; *j*, as already said, is pronounced like *y*; *rz* has a sound compounded of that of *r* and the sound of *z* in the word *azure*, sometimes almost the same as the latter sound alone; *s* is sounded like *sh*, but very soft; *sz* is pronounced like our *sh*; *w* has the sound of *v*; *z* is pronounced like *s* in *azure*; *z* has the same sound, but softer. Before the termination *ski* the *w* is not pronounced in proper names; thus, *Poniatowski* is pronounced *Poniatoski*. The consonants *b*, *p*, *l*, and *n* are sometimes softened by the addition of a sound like that of *y* in *yes*, the *l* and *n* in this case sounding like the Italian *gl* and *gn*. When so sounded these consonants are distinguished by a mark like an acute accent placed above or beside them (*b', p', l', n'*), or by an *i* following them. The latter mode of distinguishing them is used, especially when the sounds in question are followed by a vowel. The consonant *c'* has a sound absolutely peculiar to the Polish language: it resembles that of *t* followed by or combined with a very soft *sh*. The barred *l* (*ł*) has a sound common to the Polish with other Slavonic tongues: it is produced by sounding the letter *l* with the point of the tongue thrown well back in the mouth, and firmly pressed against the palate. Among the vowels *e* and *a* are pronounced respectively like the French semi-nasals *en* and *on*; *i* has the sound of *i* in the English word *pique*; and *y* has a sound resembling that of the German *ü*. The tonic accent in Polish words is nearly always on the second last syllable.

The grammatical forms of the Polish are more numerous than those of any other living Indo-European language. There were formerly three numbers, the singular, dual, and plural; but the dual has been preserved only in the Mazovian dialect. There are three genders, masculine, feminine, and neuter; and seven cases, the nominative, genitive, dative, accusative, vocative, instrumental, and locative. The Polish language thus possesses all the cases of the Sanskrit, except the ablative. The diminutives and augmentatives are much more numerous in Polish than even in Italian. The inflections of the verbs indicate not only persons and numbers without the aid of personal pronouns, but also the genders of the persons speaking, and the persons spoken about. The only tense for which an auxiliary is required is the pluperfect. Besides the distinction of conjugations, there is another according to which verbs are classified as perfect and imperfect, according as they

express a single or a habitual act or event. This immense variety of inflections in Polish permits the use of inversion in the structure of sentences to as great an extent as it is practised in Latin.

The principal dialects of Polish are the Mazovian, which is spoken in the districts round Warsaw; that of Great Poland, which is chiefly spoken in the districts round Posen, Gnesen, and Kalisz, and of which the written language of Poland is a development; the Silesian, spoken to the east of the Oder; the Cracovian, or the dialect of Little Poland; and the Polish-Lithuanian, as distinguished from the Lithuanian proper.

Of the grammars of the Polish language, after that by the Piarist Copczynski, may be recommended those by Bandtke (a new edition, Breslau, 1824), by Mrozinski (Warsaw, 1822) by Muczkowski (Cracow, 1845); by Malecki (Lemberg, 1879), and Morfill's Simplified Grammar of the Polish Language (1884). Of Dictionaries, that by Bandtke (Breslau, 1806), and the great one by Linde, are the most valuable. The latter is in six quarto volumes (Warsaw, 1807-14; new edition, 1854-61). An Anglo-Polish Lexicon was published by Trubner, 1884.

Polish Literature.—The Polish literature reaches back to a more remote period than that of any other Slavonic language except the Bohemian, and in importance far surpasses the other Slavonic literatures, Bohemian, Servian, and Russian. According to Estreicher, author of the Polish Bibliography, it comprises two-thirds of all the Slavonic literature. The oldest monuments of the literature of Poland consist of warlike, historical, political, and religious poems, more especially the last. They have come down to us partly in Polish and partly in Latin, these being probably translations of Polish originals. The most celebrated of those written in Polish is the *Bogorodzica Dziewica*, a hymn in honour of the Virgin, which the Polish soldiers were accustomed to sing on the eve of battle. It is said to have been composed by Adalbert, archbishop of Prague, at the end of the tenth century, and accordingly at the time when the first Christian king reigned in Poland. The next literary remains of the country are all in Latin, and consist mostly of chronicles written by the monks. The earliest of these date from the twelfth century, and the principal are those by Mart. Gallus (about 1109), Wincenty Kadlubek (died in 1223), and Boguphalus (died 1255), and the chronicle of the popes and German emperors, by Mart. Strzelski or Polonus (died in 1279). The first three of these are contained in Mizler's Collection (Warsaw, 1761). A new edition of Wincenty Kadlubek's *Res gestæ Principum ac Regum Poloniæ* appeared at Warsaw in 1824, together with Dzierzwan's *Chronicon Polonorum* (of the thirteenth century). After a long period of comparative inactivity literature revived in the fourteenth century under Casimir the Great, the founder of the University of Cracow. The mathematical sciences became especially flourishing, and two Poles, Johannes Glogoviensis (died 1507) and Wojciech Brudzewski (died 1497), the latter the teacher of Copernicus and the author of several astronomical works, were among the most distinguished men of their time in that department. The progress of civilization and culture is still more noticeable in the works of Jan Dlugosz (died 1480), author among other things of a History of Poland, written in Latin, and in the establishment about 1490 of the first Polish printing-press at Cracow.

Under the prosperous reigns of the first two Sigismunds (from 1507 to 1572) Polish was raised to the rank of a written language, and the proper national literature began. Science and scholarship received a large share of attention, and the literatures of

Greece and Rome especially were widely studied, but pure native literature was not wanting. Nicolas Rej (died about 1568) and Jan Kochanowski (died 1584) attained eminence as poets, the latter as a lyricist of the highest rank. Piotr Kochanowski, a younger brother of the preceding, is the author of an admirable translation of Tasso's *Jerusalem Delivered*. Among the other poets of the century were Sęp Szarzynski (died 1581), an edition of whose works was published by Muczkowski at Posen in 1827, and Szymonowicz (Simonides), celebrated both as the author of Polish Idylls, written after the manner of Theocritus, with a natural and easy grace; and as a composer of Latin odes, which earned for him the title of the Latin Pindar. An edition of his idylls (*Sielanki*) was published at Leipzig in 1837. It was in the sixteenth century also that the first histories in the language of the people were written. These were the works of Marcin and Joachim Bielski, who were followed by Lukasz Górnicki (1535-91), author of a History of the Crown of Poland, published at Cracow in 1637, and again at Warsaw in 1804. There was likewise considerable activity during this period in the theological field, which was due to the introduction and spread of the reformed faith. Controversial works were numerous, and translations of the Bible or part of it were made by scholars on both sides. The first translation of the New Testament into Polish was made by Jan Seklucyan, and was published at Königsberg in 1551. It was intended for Protestants. For the Catholics a translation of the whole Bible was made first by Leopolda, and afterwards by Wujek. The latter was one of the most learned theologians of his time. His translation appeared at Cracow in 1598.

The flourishing period of Polish literature continued through the whole of the sixteenth century and into the first quarter of the seventeenth, and was followed by a period of Jesuit supremacy and literary decline, which lasted till about the middle of the eighteenth century. The decline was only checked for a time by the efforts of some powerful minds, principally of General Zamojski. The original productions of this period are few and unimportant. Translations, on the other hand, are numerous. Thus Cieszkowski translated Lucan; Morawczyn, Corneille; the Jesuit Nagurczewski (1719-1811), Homer's *Iliad* and Virgil's *Eclogues*. History was perhaps the most flourishing branch of literature, but the historians again resorted for the most part to the Latin language as a literary medium. The names of Kojalowicz, author of the *Historia Lituanie*; and Jędrzej Wegierski (died 1549), author of *Slavonia reformata* (Amsterdam, 1679), an exhaustive history of the Dissidents in Poland, may be singled out as the chief. Wegierski also did good service as a historian of literature.

After the middle of the eighteenth century the influence of the French civilization was widely felt in Poland, and prepared the way for the revival of letters. The introduction and spread of this influence were due partly to the fact that numerous Poles of rank, who had gathered about the court of the ex-King Stanislaw Leszczynski in Lorraine, had returned to their native country with the impress of French ideas on them; partly to the encouragement given to French culture by King Stanislaw Augustus; but more than all, perhaps, to the exertions of the Piarist Stanislaw Konarski, who, though not himself an author, was an ardent patron of letters and supporter of the cause of education and learning. The most distinguished authors of this part of the eighteenth century are Adam Stanislaw Naruszewicz, who produced a History of Poland and an excellent translation of Tacitus; and the poet Ignacy Krasicki (1734-1801), the unquestioned head of Polish litera-

ture during his own time. The dramatic literature of this period is tame, being chiefly distinguished by a formal adherence to the laws of the French stage. The literary activity of Poland did not cease after the overthrow of the political independence of the country, but on the contrary increased and took a more healthy direction. It is indeed only since the country lost its independence that its literature has acquired a European importance. From the year 1815 the literary centre of Poland was Wilna, where a number of the most enthusiastic spirits of the country, with Mickiewicz at their head, associated together and endeavoured to propagate the influence of recent English and German literature in opposition to the prevailing French tendencies, and this notwithstanding the fact that most of them, and indeed nearly all the greatest Polish writers of the period, ultimately took up their residence in France. By far the greatest of the poets of the time referred to are Mickiewicz, Slowacki, and Krasiński. Adam Mickiewicz (1798-1855) is chiefly celebrated as the author of *Konrad Wallenrod* (St. Petersburg, 1828), an epic poem which had a remarkable effect in rousing the national spirit; and *Pan Tadeusz* (Paris, 1834), another epic of a thoroughly national character, giving a faithful picture of common life in Poland; Juliusz Slowacki (1809-49) was equally distinguished as a lyricist and a dramatist, and was also the author of a considerable number of short epics. Zygmunt Krasiński (1812-59) was the author, among other works, of *Nieboska komedya* (the Infernal Comedy, 1837-48) and *Irydion* in Rome, in both of which he portrays in mystical pictures the past fortunes of the Slavonic race, and points to the brighter future which he fully believes awaits it. Among the other poets may be mentioned Antoni Edward Odyniec, author of several ballads and historical dramas (among others *Barbara Radziwiłłówna*) and translations of Byron's *Bride of Abydos*, Sir Walter Scott's *Lady of the Lake*, and Schiller's *Jungfrau von Orleans*. Novel-writing was much cultivated during the nineteenth century among Polish writers, as among those of all other countries. The principal writers who have excelled in this department are Skarbek, Bernatowicz, and Czajkowski. Great efforts have been made within the nineteenth century to recover and preserve the ancient popular songs, fables, proverbs, &c., of Poland that have been handed down by tradition from age to age. Careful collections of the popular songs and ballads have been published by Wojcicki (Warsaw, 1836), Wacław (Lemberg, 1833), Pauli, Lipinski, Roger (Breslau, 1863), and others. The popular legends have been collected and published by Wojcicki (*Klechdy*, two vols. Warsaw, 1837). In the drama the Poles have been more successful during the nineteenth century than they were in previous periods. One result of the repression of the French influence by that of England and Germany was the casting off the fetters by which that species of literature had been bound, and in the freedom which they thus obtained the dramatic writers produced works of greater energy and truth. The principal dramatic writers besides those already mentioned are Jan Nepomucyn Kaminski (died 1855), the translator of Schiller and Calderon; and Fredro, the greatest of the Polish comic dramatists. In other departments of literature there may be mentioned Joachim Lelewel (1786-1861), author of *Dzieje polski* (History of Poland; Warsaw, 1829), continued under the title of *Polska odrazdzająca się* (Brussels, 1843), down to the end of the events of 1830-31; Narbutt, author of a comprehensive and accurate History of Lithuania (Wilna, 1835-41); Bandtke, Maciejowski, Bartoszewicz, also historians; Śniadecki, Goluchowski (a

disciple of Schelling), and Kremer (a disciple, at least in the earlier part of his career, of Hegel), the principal philosophers; Jarocki, a zoologist; Tyzenhaus, an ornithologist; Czerniakowski, a botanist; and Zeisner, a geologist. At the present day there are more periodicals published in the Polish language than in any other Slavonic language. In 1874 more than fifty periodicals were published at Warsaw alone. In Prussian Poland the number of periodicals is very considerable. Most of them are popular, illustrated, or agricultural journals. At Posen is published the leading Polish journal, the organ of the Polish deputies to the German Reichstag. It is called the *Dziennik poznański*. Owing to the backward state of education in Austrian Poland the periodical press is not so widely developed there as in other parts of Poland. Besides the periodicals published in Polish in the districts formerly composing the Kingdom of Poland, a Polish journal is published in Switzerland, another in England, and a third in the United States. Among the best works on the history of Polish literature are the *Historia Literatury Polskiej*, by Wiszniewski (Cracow, ten vols. 1840-57); *Dzieje Literatury w Polsce* of Kondratowicz (Wilna, two vols. 1852); the *Historia Literatury Polskiej*, by Wojcicki (Warsaw, new edition, four vols. 1859-61); and the *Geschichte der Polnischen Literatur* of Nitschmann (1883). See also Estreicher's bibliography (Cracow, 1870).

POLAR BEAR. See BEAR.

POLAR CO-ORDINATES. See MATHEMATICS.

POLAR EXPEDITIONS. See NORTH POLAR EXPEDITIONS and SOUTH POLAR EXPEDITIONS.

POLARIS (the pole star), the star α of the constellation *Ursa Minor*. It is at present near the north pole, and many centuries must elapse before precession will cause the north pole to be defined by any other star. Two stars called the pointers, in the constellation *Ursa Major* (the Great Bear, commonly called the Plough), always point in the direction of the pole-star, and enable it to be found readily.

POLARIZATION. When a particle of a body possesses properties related to a certain line or direction in the body, and when the body retaining these properties is turned, so that this direction is reversed; then if, as regards other bodies, these properties of the particle are reversed, the particle, in reference to these properties, is said to be polarized, and the properties are said to constitute a particular kind of polarization. Thus, we may say that the rotation of a body about an axis constitutes a kind of polarization, because if, while the rotation continues, the direction of the axis is turned end for end, the body will be rotating in the opposite direction as regards space. A conducting particle through which there is a current of electricity may be said to be polarized, because if it were turned round, and if the current continued to flow in the same direction as regards the particle, its direction in space would be reversed. In speaking of the state of the particles of a magnet as magnetic polarization, we imply that each of the smallest parts into which a magnet is divisible has certain properties related to a definite direction through the particle, called its axis of magnetization, and the properties related to one end of this axis are opposite to the properties related to the other end: the properties which we attribute to the particle are of the same kind as those observed in the complete magnet, and in assuming that the particles possess these properties, we only assert what we can prove by breaking the magnet up into small pieces, for each of these is found to be a magnet. See Clerk Maxwell's *Electricity*.

Polarized light, tensions and pressures in solid

bodies, extensions, compressions, and distortions, and most of all the optical, electrical, and magnetic properties of crystallized bodies are polarizations which do not agree with the above definition. These are said to be 'dipolar' properties. The rotation of the plane of polarized light by magnetism is, like magnetism itself, a unipolar property. For other phenomena to which the term polarization has been applied, see GALVANIC BATTERY, RESISTANCE.

POLARIZED HEAT. Radiant heat and light are found to be analogous in their reflection, refraction, and absorption. (See RADIATION.) Malus and Berard showed that, like light, a ray of heat might be polarized. (See POLARIZED LIGHT.) Forbes in 1834 proved that heat which had passed through tourmaline was polarized in a plane perpendicular to the axis of the crystal, for he found that it was unable to pass through a second tourmaline (the analyzer) when the plates were crossed, although it was transmitted in other positions of the plates. In his experiments he employed Melloni's multiplier and thermopile to measure the intensity of the radiant heat. He found that the analogy between the two agents light and radiant heat is as complete as his experiments were capable of showing, and his results have been fully borne out by other observers.

POLARIZED LIGHT. Rays of light proceeding from the same luminous point and travelling over paths of slightly different lengths, to fall upon a screen together 'interfere' with one another just as two rays of sound might interfere. (See INTERFERENCE.) But it is found that if a ray of light be made to pass through a crystal of Iceland-spar (which causes it to divide into two rays passing through the crystal in different directions), and if the two rays into which it divides be made to fall on the same part of a screen no variation in the relative lengths of the paths of these rays will enable them to interfere with one another, but either of them may be split up into two interfering rays. Experiments of this kind prove that the vibrations of particles of the ether which constitute light are motions at right angles to the direction of their propagation, that is, at right angles to the ray.

A lamina cut from a crystal of tourmaline, its planes being parallel to the axis of the crystal, allows a ray of light to pass through it; but in transmitting the light it modifies it in a peculiar way, for the light is now unable to pass through a second and similar parallel plate of tourmaline in certain relative positions of the two plates. If *AB* and *A'B'* are lines in the two plates of tourmaline parallel to the axes of the original crystals; when *AB* is at right angles to *A'B'* the light transmitted by one plate is stopped by the other; when *AB* is parallel to *A'B'* the light transmitted by one plate is freely transmitted by the other.

Now a common ray of light exhibits the same properties on all sides; but a ray transmitted by a plate of tourmaline, or indeed any reflected or refracted ray of light, exhibits different properties on different sides. Thus, using a plate of tourmaline like that just spoken of as 'an analyzer,' we find that when a ray of ordinary light passes through it normally the intensity of the transmitted light is the same in all positions of the plate; but rays which have already been reflected or refracted lose more intensity in passing normally through the plate in certain positions of the plate than in others. A ray which is wholly incapable of passing through a plate of tourmaline in a certain position is said to be polarized in a plane parallel to the axis of the original crystal. We know that light vibrations are executed at right angles to the ray; in ordinary light the vibrations are executed in all directions in planes at right angles to the ray; but in polarized light the vibrations are all executed in one

direction, which is of course at right angles to the ray, but which is also at right angles to a certain plane; this plane is called the 'plane of polarization.' Thus the polarized ray which is incapable of passing through the tourmaline plate consists of vibrations executed at right angles to the plane containing the axis of the crystal. The existence of rays having different properties on different sides was regarded by Newton as a decisive objection to the undulatory theory of light. Huygens, the founder of the undulatory theory, was unable to account for the phenomenon. The vibrations of the ether were supposed by Huygens to be longitudinal, or to be executed in the direction of propagation of the light. Later experimental researches (see the article *Light* in *Watt's Dictionary of Chemistry*) and mathematical investigation showed that the vibrations are all executed in planes perpendicular to the direction of propagation, and removed all difficulty in accounting for polarization. The dynamical theory shows that two rays whose planes of polarization are parallel to one another interfere just like unpolarized rays; but two rays whose planes of polarization are perpendicular to one another do not exhibit any phenomena of interference whatever may be their difference of phase. We have enunciated the theory of polarized light which has hitherto been accepted by physicists. It is, however, generally regarded as incomplete. We proceed to describe some of the phenomena which it explains.

Light may be polarized in any of the following ways:—1. *By reflection* from the surfaces of transparent bodies. A ray reflected from glass at an angle of $54\frac{1}{2}^\circ$ (called the 'polarizing angle') with the normal to the surface is completely polarized in the plane containing the incident and reflected rays. A glass surface parallel to the first is in the best position for reflecting the polarized ray. If the second surface is in such a position that the second plane of incidence (containing the ray and the normal) is at right angles to the first plane of incidence no light is reflected at the second surface. Brewster discovered that the polarizing angle for any medium is that for which the refracted ray is at right angles to the reflected ray, and hence the polarizing angle is the angle whose tangent is equal to the index of refraction of the medium. M.M. Biot and Arago and others have determined the following table:—

	Polarizing angle		Polarizing angle
Fluor-spar	$54^\circ 50'$	Sulphate of barium	$58^\circ 0'$
Water	$52^\circ 45'$	Iceland-spar	$58^\circ 28'$
Glass	$54^\circ 35'$	Antimony glass	$64^\circ 48'$
Selenite	$56^\circ 8'$	Chromate of lead	$67^\circ 49'$
Rock-crystal	$57^\circ 28'$	Diamond	$68^\circ 8'$

Few substances are capable of completely polarizing light by reflection, and, as a general rule, substances with a high index of refraction polarize incompletely. Brewster says that it is only those substances whose index of refraction is less than 1.7 which polarize completely, those not marked with an asterisk in the above table for instance. When the incident light is bright the polarization is never complete. In general bodies which are bad reflectors polarize nearly all the light reflected. Clean, polished, metallic surfaces polarize very badly indeed. Brewster's rule gives the angle of maximum polarization. Light is polarized more or less at all angles of incidence. The polarizing angle for red light is evidently slightly different from the angle for blue light. Light reflected in the same plane a number of times tends in all cases to become completely polarized. Malus' polariscope is shown in the figures. A ray becomes completely polarized by reflection at the glass plate or bundle of plates (blackened at the back) *A*, and proceeds verti-

cally to a second plate, *B*, which is suspended in a frame capable of turning about a vertical axis. *A* may be called the polarizer, *B* the analyzer. The angles through which the frame of *B* is turned may be measured. Each of the mirrors ought to make an angle

Fig. 1.

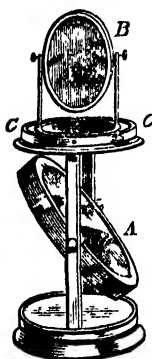
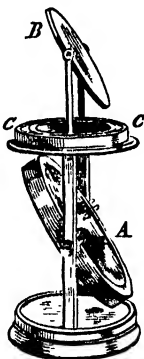


Fig. 2.



of $35\frac{1}{2}^\circ$ with the vertical, and a strong beam of light ought to fall on *B* at such an angle that it is reflected vertically. If the observer looks at *B* so as to receive the reflected beam he finds that as the frame of *B* is rotated there are two positions (differing by 180°) of minimum reflection. They are 90° on either side of the position in which the mirrors are parallel—a position which gives the greatest amount of reflection. The polarization of light by reflection was discovered in 1810 by Malus, a French engineer officer, in examining the light reflected from the windows of the Luxembourg by means of an analyzer of Iceland-spar.

2. *By ordinary refraction.* When light passes obliquely from one medium into another the refracted ray is more or less polarized, its plane of polarization being perpendicular to the plane of polarization of the reflected ray. The polarization of a ray is incomplete after only one refraction; for complete polarization the ray ought to fall not on one plate merely but on a bundle of plates of glass or other medium at the polarizing angle.

8. *By double refraction*, a property common to all crystals not belonging to the regular system. A ray of light entering Iceland-spar, for example, divides into two rays, which have different directions and velocities in passing through the crystal. However in a certain direction, called the optic axis of the crystal of Iceland-spar, there is no double refraction. This axis is parallel to a line joining the obtuse summits of a rhomb with equal edges. Any plane parallel to the optic axis is called a 'principal plane' of the crystal. Now the two rays usually formed by double refraction are found to be completely polarized; one, the 'ordinary ray' (which see), is polarized in the principal plane; the other, the 'extraordinary ray,' is polarized in a plane at right angles to the principal plane. If one of these rays might be destroyed, we should have an excellent means of obtaining a beam of polarized light. Now it is found that tourmaline possesses double refraction, but it absorbs light which is polarized in a principal plane, transmitting only the light which is polarized at right angles to this plane, and hence the use of this crystal as a polarizer or analyzer. In the Nicol's prism (which see) one of the two polarized rays of Iceland-spar is destroyed by internal reflection, the other passing through completely polarized.

Applying dynamical principles to the theory of polarization, it is easy to find the motion of particles

of ether when transmitting two or more systems of polarized waves at the same time. Supposing a particle, when transmitting a polarized wave of light, to vibrate in a straight line; when it transmits two polarized waves (of the same wave-length, that is, of lights of the same colour) it combines them into a single wave. Thus if for both polarized waves it vibrates in the same line the resultant wave is polarized, the direction of vibration of the particle remaining the same, but the intensity of the light being altered in a way which depends on the phases of the constituent vibrations. Vibrations in different lines have for resultant a straight-line vibration if the phases of the constituents are the same, or differ by π or 180° ; but in all other cases the resultant motion of the particle is circular or elliptic. We see, then, that two polarized rays (which must originally have come from the same luminous point) may combine to form a ray polarized in the same or in a different plane, but that in general, when combined, they form what may be called a ray of circularly, or a ray of elliptically, polarized light. Thus at any instant in a wave of circularly polarized light the ether particles form a circular screw-line, of which the direction of the ray is axis. The polarization is 'left-handed' or 'right-handed' according to the direction of rotation of the particles about the axis. Circularly polarized light behaves in many ways like ordinary light. In a wave of elliptically polarized light the ether particles form at any instant an elliptic screw-line about the direction of the ray as axis. The polarization may, as before, be left or right handed. When examined by means of an analyzer (a Nicol's prism, for instance) an elliptically polarized ray is transmitted with maximum intensity in two positions of the analyzer, and with minimum intensity in other two positions, but it never disappears like plane-polarized light.

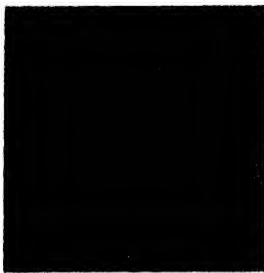
In uniaxial crystals (see OPTIC AXIS) the elasticity of the ether seems to be greatest (negative crystals) or least (positive crystals) in the direction of the principal crystallographic axis, but it is equal in all directions at right angles to this axis. It is therefore evident that a wave which depends for its velocity of propagation on vibrations of ether particles parallel to the axis of a negative crystal will travel faster than one depending on vibrations at right angles to the axis. Therefore a ray of light polarized in a plane at right angles to the axis travels faster than a ray polarized in a plane parallel to the axis. Now when a ray of ordinary light falls on such a crystal it sets the ether particles of the crystal in vibration in two planes at right angles to one another; one of these systems of vibrations is transmitted faster than the other, and consequently (see UNDULATORY THEORY OF LIGHT) is transmitted in a different direction. In biaxial crystals the ether elasticity is different in different directions. For the application of the theory of polarization in explaining the actions of uniaxial and biaxial crystals, polarization by reflection at the surfaces of transparent media and metals, &c., we must refer our readers to the article *Light* in Watt's Dictionary of Chemistry, and to the special treatises of Airy and Verdet.

Thin plates of double-refracting crystals when viewed in polarized light sometimes exhibit a most brilliant coloration, the observation of which affords in many cases an easy way of determining the position of the axes of the crystal, &c., and the phenomenon is therefore of very great service in the study of crystalline structure. Let a plate of selenite, $\frac{1}{16}$ th inch thick, or a similar plate of mica, be placed between any polarizer and analyzer. Thus it may be placed between two tourmalines or two Nicol's prisms, but we shall suppose it placed at the middle

POLARIZATION OF LIGHT.



1. Calc-spar: dark cross



2. Calc spar: light cross.



3. Two plates crosswise:
hyperbolas.



4. Potassium nitrate: dark cross



5. Potassium nitrate: hyperbolas.



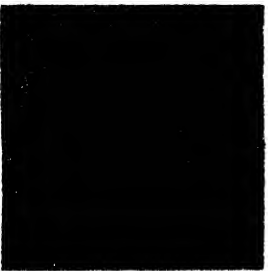
6. Sugar: rings approximately
circular.



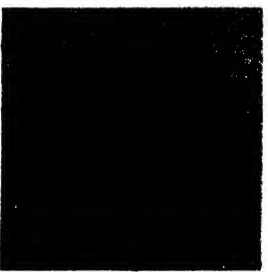
7. Quartz: circular rings.



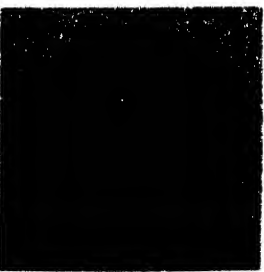
8. Quartz: quadrate rings



9. Quartz: quadrate spirals.



10. Aragonite: crosswise. Sodium
light



11. Quartz: Airy's spirals



12. Aragonite: crosswise. Sodium
light.

of the ring *c* in Malus' polariscope. Suppose *A* to receive a beam of light which it reflects to *a*, but which (the selenite being away) is not reflected by *a*, fig. 1, and which is well reflected by *a*, fig. 2. Now let the selenite be placed in the path of the light reflected from *A* and it will be found that *a*, fig. 2, reflects some of the light which passes through the plate. The selenite, therefore, alters the polarized beam in some way in transmitting it, and this alteration is further shown by the light being coloured. In fact, it has given to some of the tints of white light the power of interference (which see), so that they are destroyed. Viewed by reflection from *a* the selenite is brightly coloured; if it is of uniform thickness the colour is the same all over. Now, as *a*, fig. 1, is turned into the position *a*, fig. 2, a gradual change from a colour to its complementary takes place. Rotation of the selenite merely alters the depth of colour without changing its tint, and in certain positions there is a complete absence of colour. When the plate is not of uniform thickness its colour is not the same everywhere; but whatever may be its colour at any place in the position of the analyzer, fig. 1, it changes to the complementary tint on rotating the analyzer through a right angle to fig. 2. A thin plate of selenite, ground to a thin edge so that it is really a thin prism, shows a series of coloured bands tinted like Newton's rings.

In every position of the thin plate of selenite except two a polarized ray in passing through it

divides into two rays polarized in planes at right angles to one another. Let us consider a particular kind of light, red, for example; the two rays, *x* and *y*, travel through the plate with different velocities, and on leaving the plate they differ in phase; let us suppose that they differ in phase by half a wavelength; they would interfere and destroy each other, only that they are polarized in different planes; when they fall on the analyzer each of them becomes divided into two, one polarized in such a way that it can be reflected, the other being destroyed. Thus of the red light reflected by the analyzer part belonged to *x* and part to *y*, and as these two components differ in phase by half a wave-length if they have equal intensities they destroy one another. Thus no red light appears, and green, the complementary colour, is the predominant tint. This rough sketch of the explanation of the phenomena may induce readers of the articles INTERFERENCE and UNDULATORY THEORY to consult special treatises.

When the thin plate has been cut from a uniaxial crystal at right angles to the optic axis we no longer find it of a uniform colour. We see a system of coloured rings interrupted when the analyzer is in the critical positions of figs. 1 and 2 by a black or a white cross. (See *A* and *B*, fig. 3.) With monochromatic light the rings are alternately bright and dark. With white light the appearance is somewhat like Newton's rings. When the analyzer is not near one of its critical positions we find that there are really

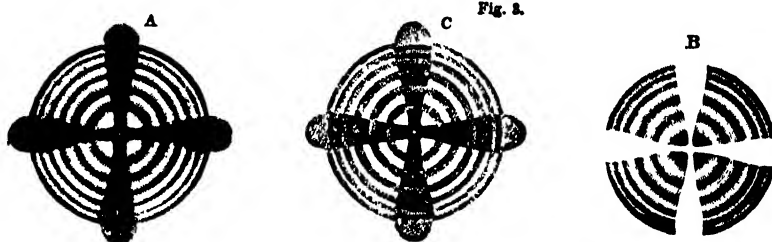


Fig. 3.

two colourless crosses; but near a critical position of the analyzer one of these crosses breaks up into rings as *C*; they coincide in the critical positions. The rings observed in biaxial crystals under similar circumstances are indicated in (the analyzer being in the position, fig. 1) fig. 4. The curves are lemniscates.

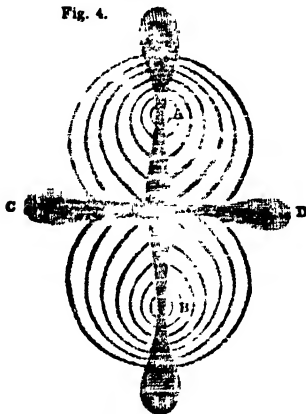


Fig. 4.

the optic axes of the plate makes 45° with the planes of polarization in the instrument, become branches of hyperbolas. When the analyzer is in the position fig. 2 the appearances are the same as before; but the crosses are white and the colours of the rings are complementary to what they were before. Fig. 4 represents the appearance in nitre, whose optic axes are inclined at a small angle not exceeding 5° or 6° . When the axes are more inclined only one half of the figure can be seen at once.

Glass in a state of strain exhibits coloration when placed between a polarizer and analyzer, and thus we can investigate the distribution of the strain through its substance. Unannealed glass is in a state of permanent strain. A plate of ordinary glass may be strained by a force applied to its edges by means of a screw. The state of strain may be varied during the examination of the plate by polarized light. The coloration observed when bodies are examined by polarized light is the best test of double refraction.

We shall now consider the very remarkable phenomenon of the rotation of the plane of polarization exhibited in quartz, a few metallic salts, the sugars, camphor, starch, and a great number of other organic substances. A plate of quartz (a uniaxial crystal) cut at right angles to the optic axis exhibits, when placed between an analyzer and polarizer, a system of coloured rings like any other uniaxial crystal; but we find that the centre of the rings, instead of having a black cross, is brightly coloured—red, yellow, green, blue, &c., according to the thickness of the plate.

When the thin plate is turned the whole system of rings turns in the same direction; the black cross separates into two branches, which, when the plane of

On turning the analyzer we find each colour appearing in its turn, and then making way for the next of the ordinary prismatic series, from red to violet, or from violet through green to red. Suppose the quartz to be examined by monochromatic light—say that a plate of red glass has been interposed between the polarizer and the quartz. Now let the polarizer and analyzer (A and B) be crossed, as in fig. 1, so that no light is reflected from B, and let the quartz be interposed, we find that a red light makes its appearance, and to destroy this light it is necessary to turn the analyzer through a certain angle. It is evident that the plane of polarization of the light has rotated during its passage through the quartz. The same effects are observed with any other monochromatic light, but the angle of rotation is least for red and greatest for violet light. The angle of rotation is proportional to the thickness of the quartz plate, and if a solution of sugar in a tube with plane glass ends is interposed instead of the quartz, the angle of rotation is found to be proportional jointly to the length of the tube and to the strength of the solution. Some crystals of quartz rotate the plane of polarization in a positive and others rotate it in a negative direction, and hence the distinction between right-handed and left-handed quartz; but the same amount of rotation is produced by the same thickness of quartz on a ray of a given colour whether the rotation is positive or negative. The angles of rotation for the different simple colours are nearly proportional inversely to the squares of the wave-lengths; this law is approximately true for most substances which exhibit rotation of the plane of polarization. The tint produced with a quartz plate 3.75 millimetres thick, when the analyzer is in the position of fig. 2, deserves particular notice. It is a purple tint, which changes very rapidly to red or violet as the analyzer is turned one way or the other. It is distinguished by the name 'sensitive or transition tint.' It is used as the standard tint in measuring the rotations produced by different substances, because of the facility and certainty with which it may be recognized. It is much easier to seize the exact moment when this tint makes its appearance than to determine with certainty the time of disappearance of red, yellow, or any other simple colour.

Faraday in 1845 made a discovery which must be regarded as the most important of his achievements. His discovery of current induction might have been arrived at by applying thermodynamical principles to Oersted's results; but in the discovery of the rotation of the plane of polarization of light by magnetism he had absolutely no previous experience such as would have led him to imagine a connection between magnetism and light. Professor Clerk Maxwell's theory of light as the propagation of an electromagnetic disturbance in the ether was no doubt suggested by Faraday's discovery, although founded on the agreement between the velocity of light as determined by Fizeau and Foucault, and by means of aberration and a certain ratio, a velocity, well known in electricity. His explanation of Faraday's magneto-optic rotation is not quite satisfactory. We shall describe Faraday's experiments, and then indicate the direction which they have given to Sir Wm. Thomson's investigations. A bar of heavy glass was placed between the poles of a powerful electro-magnet; the two poles were made hollow, and each of them carried a Nichol's prism; one of these prisms passed a beam of polarized light along the axis of the bar of glass, the other analyzed the light after it had passed through the glass. The prisms were first crossed. No current passed round the soft iron of the electro-magnet, and therefore there was no magnetic field between the poles. No light was found

to pass through the analyzer; but when a strong current of electricity passed through the wire surrounding the soft iron, and therefore a powerful magnetic field was produced between the poles, light was found to be transmitted by the analyzer, but rotation of the analyzer again produced darkness. Thus Faraday's glass in its normal condition is unable to rotate the plane of polarization of light, but power of rotation is given to it by placing it in a magnetic field. The amount of rotation is proportional to the strength of the current and the length of the path traversed by the light in the glass. The direction of rotation is always the same as the direction in which the current passes in the coils of wire of the magnet. The phenomenon is not so marked in flint-glass as in Faraday's heavy glass; it is observable in all transparent solids and liquids. If the medium has a rotatory power of its own the total effect is equal to the sum or difference of the natural and induced rotations, according as the magnetic force acts with or against the natural rotatory power of the medium. The rotation is greatest when the lines of magnetic force of the field (which see) are parallel to the ray, and Verdet has shown that when the magnetic action is oblique to the ray the rotation is proportional to the cosine of the angle contained between the direction of the ray and the magnetic action or lines of force. Faraday's law, that the direction of rotation is the same as that of the current, was found by Verdet to be true only of diamagnetic substances. Faraday at first attributed the observed effects to the direct action of the magnet on the light, but he was afterwards convinced that the rotation is due to a change in the molecular structure of the medium produced by the magnetism. Hence magneto-optic rotation is rarely developed in crystals, because crystallization interferes with molecular displacement. Hence also the development of this power is hindered by pressure and favoured by heat.

Sir Wm. Thomson (Lord Kelvin) seems to have no doubt that magnetic phenomena are due to an alignment of axes of rotation of a very great number of small bodies like gyroscopes. It is well known that a gyroscope quite free to move will place its axis parallel to the earth's axis of rotation. He has been building up a mathematical theory of magnetism on the above basis. He has investigated the relative motions of attached gyroscopes. One of his results is of great interest in connection with magneto-optic rotation. If one end of a cord is fixed to the ceiling, the other end being held in the hand, and if the hand be moved in a straight line, a plane polarized wave will run from the hand along the cord and back again. Lord Kelvin has shown that if instead of a cord we have a uniform chain of equal gyroscopes (each gyroscope being attached to its two neighbours by means of equal weightless links), a straight-line motion of the hand sends as before a polarized wave towards the ceiling, *but the plane of polarization rotates as the wave advances.*

POLARS, RECIPROCAL, the name given to a method of mathematical investigation. If Σ is a given fixed conic section, and if S is a given curve, another curve s may be generated as follows. Draw any tangent to S , and take its 'pole' with regard to Σ (the pole of a line cutting a conic section is the point of intersection of the two tangents drawn at the points in which it cuts the curve), the locus of this point will be the curve s . s is called the 'polar curve' of S with regard to Σ . Σ is called the 'auxiliary' conic. It may be shown that the polar curve of one conic section with regard to another is also a conic section.

POLDER, a class of agricultural lands in Holland

consisting of extensive tracts reclaimed by drainage from what had originally consisted of lakes or morasses, and generally lying below the level of the sea. The transformation of the Lake of Haarlem into a polder is a striking illustration of what can be effected through energy and patient perseverance. The usual method of procedure in the formation of a polder is to encircle the portion to be reclaimed by an embankment, and construct a canal having its bed sufficiently high to cause a current towards the sea or river. The water is then pumped into this canal by means of various pumping apparatus, worked for the most part by means of wind-mills, but not unfrequently by steam-power. After the water has been drained off the land is put into the hands of the husbandman, and this kind of soil is in general found to be very productive. The polder, however, is always liable to fresh inundations, and a considerable annual expenditure is necessary to uphold the appliances requisite either to prevent or remedy these. The inundations, unless they are of salt water, contribute for the most part to the fertility of the soil.

POLE, in astronomy, the name given to each of the two points in which the axis of the earth is supposed to meet the sphere of the heavens. In spherical trigonometry, the pole of any circle drawn on the surface of a sphere is one of the points in which the perpendicular to its plane through its centre cuts the sphere. In this sense astronomers speak of the poles of the ecliptic, &c.

In geography, either extremity of the axis round which the earth revolves is called a *pole*, or a *terrestrial pole*. The northern one is called the *north pole*, and the southern the *south pole*. Each of these poles is 90° distant from every part of the equator. See EARTH.

Pole, in physics, the points of a body at which its attractive or repulsive energy is concentrated, as the poles of a magnet, the north pole of a needle, the poles of a battery.

POLE, PERCH, or ROD, in surveying, is a measure containing 16½ feet.

POLE, REGINALD, cardinal, an eminent statesman and ecclesiastic, born in 1500, was the son of Sir Richard Pole, lord Montacute, cousin to Henry VII. by Margaret, daughter of the Duke of Clarence, brother to Edward IV. He received part of his education in a Carthusian convent at Sheen, near Richmond, whence he passed at the age of twelve to Magdalen College, Oxford, where Linacre and Latimer were among his teachers. He obtained his bachelor's degree at the age of fifteen. He entered into deacon's orders at an early age, and had several benefices conferred on him by Henry VIII., with whom he was a great favourite. In 1519 he visited Italy, and fixed his residence at Padua, where he acquired the friendship of several celebrated men, such as Erasmus, Bembo, and Sadoletto. He returned to England in 1525; but in consequence of the affair of the divorce from Catharine of Arragon, withdrew to Paris (1529), under the pretext of continuing there his theological studies. He afterwards went to Avignon, and thence to Italy, where he resided sometimes at Padua, sometimes at Venice. While staying in Italy he was ordered by Henry to give a formal statement of his opinions regarding the divorce and the question of Papal supremacy, whereupon Pole, after trying for some time to escape from this dangerous task, drew up a long and laborious epistle (*Pro ecclesiasticæ unitatis defensione*), in which he boldly condemned the divorce as unlawful, and the rejection of the Papal supremacy as a breach made in the unity of the church. The consequence of this conduct was the loss of all his preferment in England, in return for which he endeavoured to form

a party against Henry, which design terminated in the destruction of his brother, Lord Montacute, and of his aged mother, then Countess of Salisbury, whom the vindictive Henry sent to the scaffold. He was declared a traitor by the king, and a price of 50,000 crowns was set upon his head. But the countenance of the court of Rome was extended to Pole, and besides being raised to the dignity of cardinal, he was employed in various negotiations. He was also appointed one of the three Papal legates to the Council of Trent; and on the death of the pope, Paul III., was all but elected to fill the Papal chair. On the accession of Mary I. his attainder was reversed, and he was invited to England, whither he proceeded in 1554 as legate and plenipotentiary of the Papal see, and where he endeavoured to moderate the rigour of Gardiner and others against the Reformers, and was an advocate for lenient measures, and such a correction of clerical abuses as would conciliate them. On the death of Cranmer, Pole, then for the first time ordained a priest, became Archbishop of Canterbury, and was at the same time elected chancellor of the Universities of Oxford and Cambridge. On becoming archbishop he set himself to rebuild the churches, and to re-establish the ancient discipline; a rigorous persecution of Protestants was also instituted, to which he at least assented. He died on the 17th November, 1558, on the same day as Queen Mary, so that he did not live to see his labours for the re-establishment of Romanism rendered fruitless, and the Protestant religion again in the ascendant. He was buried in Canterbury Cathedral with no other epitaph than the brief inscription *Deposuit Cardinalis Poli*. Cardinal Pole seems not to have been a man of commanding talents, but he merited great esteem for his mildness, generosity, and comparative moderation, in an age when persecution was deemed lawful on all sides.

POLE-AXE, an axe attached to a pole or handle of which the length varies considerably. It was formerly used by mounted soldiers, and is yet used in the navy for boarding purposes; in the latter case the back of the axe is furnished with a hook.

POLECAT (*Mustela putorius*), a species of carnivorous animals included in the family of the Mustelids or Weasels, which in turn forms one of the divisions of the digitigrade section of the carnivorous order of Mammalia. As in the majority of the Mustelids, the body in the Polecat is elongated, the legs being short. The muzzle, however, is shortened. The teeth number six incisors, two canines, six premolars, and four molars in each jaw. The skull presents a triangular shape and somewhat flattened conformation. The neck is long and flexible. The ears are of small size, the eyes being large, and the senses of smell, hearing, and sight being very acute. As in the companion genera, and as characteristic of the Weasel family, the anal glands of the polecat—structures placed close to the base of the tail—secrete a fluid or secretion of highly unpleasant odour, and which remains disagreeably permanent when brought in contact with clothing or other material. These animals, comparatively common in Britain, measure in their adult state from 16 to 18 inches—the tail, which is short, measuring from 4 to 5 inches in addition. The under coat is dense, the outer and hairy fur being of a yellow colour, and the tips of the longer hairs being tinged of a dark-brown hue. The edges of the ears and the fur surrounding the lips are coloured white. The young, produced in spring, number from three to five. These animals inhabit burrows, lining the nest with dried grasses or similar material. The food consists of the smaller Mammalia, of birds, and poultry—the Polecat being an inveterate destroyer of domestic fowls and of game.

Like other members of the weasel tribe the Polecats suck the blood of their victims, and leave the bodies and flesh untouched. In this way they become exceedingly destructive. The Polecats, like the Otters, appear occasionally to feed upon fishes. The name of 'Foumart' is also applied to the Polecat; and its fur, which is imported in large quantities from northern Europe, is known as that of the 'Fitch'. The longer blackish hairs are used in making artists' brushes. Various processes have been adopted in dressing the furs to remove the odour of the anal glands, which generally impregnates the fur and flesh to a greater or less degree. See the plate at CARNIVORA.

POLENTA, a kind of food common in Italy, consisting of a preparation of either semolina or Indian-corn meal, mixed with water, and boiled until it thickens. It is then poured into a dish, where it becomes firm enough to be cut into slices, in which state, after being seasoned, it is eaten.

POLE (or **POLAR**) **STAR**, the last in the tail of **Ursa Minor**. See **POLARIS**.

POLICE (Greek, *politeia*, government, from *polis*, a city), a judicial and executive system, and an organized civil force for maintaining order and enforcing the laws. There are traces to be found in every organized society of some system of rules for the maintenance of peace and order. We see such traces in the Mosaic laws, and in those of the Egyptians. At the same time, a system of police in the special modern sense of the term did not exist in ancient times. In Greece it was mixed up with the totality of their institutions. In Rome, not until the time of Augustus do we find the police becoming a special institution, with a numerous staff of various grades of officers, at the head of whom stood the *præfectus urbis*. When the barbarians swept across the Roman Empire and obtained the mastery every trace of a regular system of police disappeared, and only when Charlemagne ascended the throne was there a successful attempt made to re-establish anything of the kind. But after the death of Charlemagne everything fell into confusion again. The Normans, established in the north of France, were the first who made stringent police regulations for the assurance of public tranquillity. In France, previous to the middle of the fifteenth century, the Provost of Paris and his lieutenants were charged with maintaining the peace of the city and suppressing vagrancy. Under Louis XIV. the police attained its highest measure of perfection as a repressive force. A universal system of espionage was established, and the slightest indication of impatience under the yoke of oppression, or the smallest departure from the monarch's views of what was right, was visited with summary arrest and punishment. In 1794 the National Convention reorganized the police and defined its duties, which comprised almost every department of administrative government. During the administration of Napoleon I. the city police of Paris attained a high degree of efficiency. As existing at present the French police generally is presided over by the minister of the interior; the departments and communes are under the prefects, of police and other municipal agents; Paris is under sub-prefects, and maires, assisted by commissaries the prefect of police and his numerous assistants. The police organization on the Continent generally partakes largely of a military character.

In England, from the time of the Saxon kings there had existed an organization of a partially voluntary character for the repression of crime, the arrest of criminals, and the maintenance of good order. The population was divided into hundreds, and these into tithings or companies of ten free-

holders with their families. The chief man of the hundred was the justice of the peace or local magistrate, for the trial of small causes; and the head man of the tithing was responsible for good order and the arrest of criminals in his limited district. As this system, however, was not always found to work well, the high sheriff of the county, his deputies, and the constables appointed by the parishes, were eventually substituted for the voluntary officers of the earlier period. But in process of time this system was also found ineffectual for the maintenance of public peace and security; yet no great improvement was made until 1829, when the remodelling of the police system of London led the way to the adoption of a uniform system for the whole country. In 1829 Sir Robert Peel got an act passed 'for improving the county police in and near the metropolis', a measure which brought down much invective on the head of its originator. Several modifications were introduced by subsequent acts of Parliament, and other cities and boroughs successively acquired the power to institute and maintain a police force. In 1839 and 1840 acts were passed providing for the appointment of a county constabulary, organized and maintained in accordance with rules prescribed by the Home Secretary. These acts were optional, but by 19 and 20 Vict. cap. lxi. (1856) it was made compulsory on the magistrates of every county where no police had yet been constituted to proceed therein forthwith; and accordingly there is now a county constabulary force in every county, under the periodical inspection of officers appointed by the crown.

The Local Government Act of 1888 intrusted the control and organization of the county police in England and Wales to the standing joint committee of the quarter sessions and the county council. County boroughs and other large boroughs were left with the control of their police, but in the case of small boroughs the control of the borough police was transferred to the county council. The cost of the county and borough police is defrayed partly by a special local rate and partly by a contribution from the Local Taxation Account. The Police Act of 1890 makes provision for the payment of pensions to superannuated constables who have completed twenty-five years of approved service or have been incapacitated by injuries sustained while discharging their duties. Gratuities may be paid to constables or to their widows and children in certain cases. The strength of the county and borough police of England and Wales in 1900 was 27,123, of whom 1460 belonged to Liverpool, 1000 to Manchester, 700 to Birmingham, 500 to Leeds, 499 to Bristol, and 465 to Sheffield. The Metropolitan Police has charge of an area of over 688 square miles, comprising twenty-one land divisions besides the river Thames. Each division is under the charge of a superintendent and each subdivision under that of an inspector. For executive purposes there are three districts, each under a chief-constable. The head of the whole force is a Commissioner appointed by the Home Secretary, and assisted by three Assistant-Commissioners. The financial control of this force is in the hands of a Receiver appointed by the Crown. The Criminal Investigation Department, organized in 1878, comprises a central body at New Scotland Yard, and branches in each of the divisions. The Convict Supervision Office, founded in 1880, is a branch of the last-mentioned department. The strength of the Metropolitan Police in 1900 was 15,847, comprising 32 superintendents, 570 inspectors, 1977 sergeants, and 13,268 constables. The City of London Police is under a Commissioner appointed by the Mayor, Aldermen and Common Council sub-

ject to the approval of the king. Its area is divided into three districts, each with two divisions. There is a Superannuation Fund, provided from the stoppage of 2½ per cent of the pay of the force, the fines at Police Courts, &c. The City of London Police are better paid than the other police forces of the kingdom. Their number in 1900 was 1002, of whom 885 were constables. The total number of police in England and Wales was 44,054 in 1900.

In Scotland the organization of an efficient police in the large towns dates from 1833, when a statute was passed enabling burghs to establish a general system of police. Other acts were passed in 1850, 1857, and 1862. The County and Burghs Police Act of 1857—under which an efficient rural police was first established—vested the police authority for each county in the Commissioners of Supply, but the Local Government (Scotland) Act of 1889 transferred it to a standing joint committee of the Commissioners and the County Council. The last-mentioned act also placed the administration of police in burghs and police burghs with less than 7000 inhabitants in the hands of the county committees. The strength of the Scottish police forces was 4874 in 1900, of whom 1760 belonged to county forces. Glasgow has a force of 1360 men. Part of the cost of these forces is defrayed out of the Local Taxation (Scotland) Account. The Police (Scotland) Act of 1890 established a scale of pensions and gratuities similar to that of England and Wales. There is an Inspector of Constabulary for Scotland.

In Ireland, previous to 1814, the police was in a very disordered condition. In that year a law was passed by which some minor improvements were effected. The act of 1836, and its subsequent modifications in 1848 and 1857, have greatly improved the police. In 1867 the title of Royal Irish Constabulary was conferred on the force by royal command. This force numbers 11,200, and is organized on a semi-military plan. They live in barracks, and are armed with rifles, swords, and other weapons. They are under the immediate authority of the government in Ireland, and are controlled by an Inspector-General, who is assisted by a Deputy Inspector-General and three Assistant Inspectors-General. Each county is under a county inspector, and each district under a district inspector. The Royal Irish Constabulary discharges several duties not imposed upon police forces in Great Britain, such as taking the decennial census, collecting agricultural statistics, acting as inspectors of weights and measures, and to some extent as customs and excise officers, &c. The cost of this force is almost entirely defrayed from Imperial funds. A system of pensions and gratuities has been established. In 1865 an extra force was authorized to be raised for Belfast, towards the support of which the borough was to contribute fully one-half; and in 1870 a similar arrangement was made for Londonderry. The city of Dublin and its suburbs, with an area of 32 square miles, is under a separate police force known as the Dublin Metropolitan Police. Its cost is met partly from Imperial and partly from local funds. An act of 1883 regulates the granting of pensions and gratuities. The strength of the force in 1900 was 1198.

In the United States the provisions for the repression of crime and the detection and arrest of criminals were copied from those of Great Britain. New York was the first of the cities to have a police force organized similarly to that previously adopted in London.

POLICINELLO. See **PUNCHINELLO**.

POLICY OF INSURANCE. See **INSURANCE**.

POLIGNAC, JULES AUGUSTE ARMAND MARIE, PRINCE DE, a French statesman, born at Versailles,

May 14, 1780. His parents being obliged to leave France at the time of the revolution, he went first to Russia, then a refuge for the royalists, and after that repaired to Edinburgh, where the Comte d'Artois, afterwards Charles X., was then residing. After the restoration he entered the chamber of peers. In 1820 he obtained from the pope, as a reward for his services to the Church, the title and arms of a Roman prince. In 1823 he succeeded Châteaubriand as ambassador at London; but after the accession of Charles X. (1824) spent the greater part of his time in Paris. To allay popular hatred he spoke out distinctly in the house of peers in favour of constitutional rule, and, notwithstanding, continued to stand so high in royal favour that in 1829 he was placed at the head of the new ministry, with the portfolio of foreign affairs. On the 27th July, 1830, the hatred of the people was roused to open insurrection by the ordinances issued on the 25th, and the dynasty of Charles X. was overthrown. Polignac accompanied the king to Cherbourg, and then went to Granville, where he was apprehended. The house of peers condemned him to civil death. He was forthwith taken to Ham, where he occupied himself with literature and the education of his children. By the amnesty of 1836 he recovered his liberty, and fixed his residence in England. He died at St. Germain-en-Laye on Mar. 2, 1847.

POLIGNAC, MELCHIOR DE, cardinal and diplomatist, was born in 1661. In 1693 he was named ambassador extraordinary from France to Poland, for the purpose of detaching John Sobieski from the league with Austria, and drawing him over to an alliance with France. On the death of Sobieski (1696) he was employed in endeavouring to effect the election of the Prince of Conti to the Polish throne. His intrigues, though seconded by large bribes, were, however, unsuccessful. In 1712 he was appointed plenipotentiary to the Congress of Utrecht, and was afterwards minister to the court of Rome. He received his cardinal's hat in 1713. Banished during the regency by reason of his intrigues, he was recalled in 1721, and in 1725 was despatched as ambassador to Rome, returning to France in 1732. He died on April 3, 1742. As a writer Polignac is known by his didactic poem entitled *Anti-Lucretius, seu de Deo et Natura* (Paris, 1745).

POLISHING, the process by which the surface of a material is made to assume the most brilliant appearance of which it is capable. The degree of polish or brilliancy which a given surface can take on is in general proportionable to the hardness of the material. The article to be polished must first be made smooth. The softer bodies, such as wood, alabaster, ivory, are smoothed by means of glass-paper and pumice-stone; metals, with emery, pumice-stone, and polishing-stones; glass, with sand and emery; and precious stones with emery. In the case of wood the polishing is effected by rubbing with French polish (which see). Polishing wheels are commonly used in the case of metals, being discs of wood covered with leather, and on which pulverized tripoli, chalk, rouge, tin-putty, &c., is sprinkled. Diamond powder, or the powder of other hard stones, is used to polish gems.

POLISHING-SLATE, a gray or yellow slate, composed of microscopic infusoria. It is found in large quantities in the Coal-measures of Bohemia, and in Auvergne, and is used for polishing glass, marble, and metals.

POLISH LANGUAGE AND LITERATURE. See **POLAND**.

POLITIANUS, ANGELUS (the Latinized form of *Angelo Poliziano*), a learned and elegant scholar of the fifteenth century, born in 1454 at Monte Pulciano,

in the Florentine territories, whence he derived the appellation by which he is more usually known than by that of *Cinisi*, his family name. He was educated at Florence, where he soon acquired great proficiency in the classics and in Hebrew; and studied the philosophy of Plato under Marcellio Ficino, and the philosophy of Aristotle under Argyropulo. The first production which brought him into notice was a Latin poem on the tournament of Giulio de' Medici. He assumed the ecclesiastical habit, and acquired by his accomplishments the favour of Lorenzo de' Medici, who made him tutor to his children, and presented him with a canonry in the cathedral of Florence. In 1484 he visited Rome, and met with a flattering reception from Pope Innocent VIII. After his return to Florence he lectured with distinguished success on the Latin and Greek languages, and likewise on philosophy, attracting a brilliant audience of foreigners as well as Italians. Among the most esteemed of his writings are an Account of the Conspiracy of the Pazzi; a Latin translation of Herodian; and a collection of Greek Epigrams; besides some miscellaneous works in prose and verse, and a drama on the story of Orpheus, printed in 1475. This latter piece was set to music, of which science he was passionately fond. As a Latin writer, he may be reckoned one of the first who introduced that age of revived classical Latinity which forms so prominent a feature in modern literary history. He was an industrious and skilful collator of ancient manuscripts, and gave great assistance to the editors in the early period of typography. He also extended his researches to jurisprudence, and contributed greatly to the correction and illustration of the Pandects. He died in September, 1494.

POLITICAL ECONOMY is the science which treats of the general causes affecting the production, distribution, and consumption of things having an exchangeable value, in reference to the effects of such production, distribution, and consumption upon the national wealth and welfare. The definition of this science has been a subject of some discussion. Senior defines it as 'the science which treats of the nature, the production, and the distribution of wealth;' Archbishop Whately as 'catallactics, or the science of exchanges;' Storch, as 'the science of the natural laws which determine the prosperity of nations, that is to say, their wealth and civilization;' Sismondi, as the science which has for its object 'the physical welfare of man, so far as it can be the work of government;' Say, as 'the economy of society, a science combining the results of our observations on the operations and functions of the different parts of the social body;' John Stuart Mill, as 'the science which traces the laws of such of the phenomena of society as arise from the combined operations of mankind for the production of wealth, in so far as those phenomena are not modified by the pursuit of any other object.' The definition of Malthus gives it a wider range than is conceded to it by M'Culloch, extending it to the investigation of the production and consumption of all that man desires, as useful and agreeable, according to which definition M'Culloch says it would include all other sciences, so that 'the best encyclopædia would really be the best treatise on political economy.' But M'Culloch's definition is liable to the same objection, if taken in its full literal sense; for he calls it 'the science of the laws which regulate the production, distribution, and consumption of those material products which have an exchangeable value, and which are either necessary, useful, or agreeable.' This definition would evidently, if taken in its full breadth, comprehend a very large portion of the encyclopædia. But though Malthus considered the science as comprehending all those things which man

desire as useful or agreeable, yet he undoubtedly intends to limit it to certain views of this great variety of subjects. But the definitions both of Malthus and M'Culloch seem to be too broad. Political economy refers only to the general causes affecting the productive faculties and means of a nation, meaning by *productive faculties* and *means* the capacity and resources for producing things that have an exchangeable value. Thus the constitution of government, the laws, the judicial, social, and economical institutions, the schools, the religion, morals, soil, geographical position, climate, arts, indeed all the circumstances in the character and condition of a people, as far as they have a general effect on the public wealth; in other words, the production, distribution, and consumption of commodities are subjects of this science. It is, accordingly, a science of a lofty and liberal character, not identified with that of politics, but very nearly allied to it, and, indeed, one of its branches; for a man would be but ill qualified to legislate for a state who should be ignorant of the general laws affecting its productive capacity. This being the character of the science it is not a little remarkable that it has not been more honoured and more generally studied as a distinct field of inquiry; for it has necessarily been studied and practically applied by all statesmen and rulers from the beginning of time, since the effect of all measures of the government, and all causes, upon the condition of a community must have been objects of consideration from the dawn of human reflection, though the notions of men may have been very crude, and often erroneous, upon this as upon all other sciences. Men very early studied the human body, and even formed something like a science to account for its functions; but correct notions of anatomy are of comparatively recent origin. The science of chemistry is still more recent. That of political economy, like others, has had its stages of progress, and some of its professors consider it now to be placed upon as firm a basis, and reduced to a system of rules as completely demonstrated, as that of astronomy since the time of Newton; while others consider the present state of political economy as far below a full development and demonstration of its principles as the system of the nine mundane spheres, or perhaps the theory of Tycho Brahe, as compared to modern astronomy. It certainly seems to be singular, if the rules whereby a nation may be made to flourish or decay are as well defined and as satisfactorily demonstrated as the theorems of geometry, that they should be so rarely and so imperfectly reduced to practice. Some of the fundamental doctrines of those writers who have occupied the greatest space in the written expositions of this science are not adopted by any nation whatever occupying a respectable rank in the civilized world. This might be accounted for if the doctrines in question were professedly proposed for simultaneous adoption by all nations, like those of the Peace Societies; for then the doctrines might be theoretically true, but yet fundamentally inapplicable in the actual condition of the world. But these doctrines are not proposed as being subject to this condition; they are pressed upon every single people without regard to the conduct of others, and independently of the policy that may be pursued by foreigners. It is not one of the conditions on which they are recommended that nations must be prepared for their reception by an entire revolution in national relations and policy, and that they can have place only in the train of events attending a political millennium; their advocates profess their adaptation to the present state of national rivalships and collisions of interest. It follows that the practical truth of these doctrines is not so demonstratively proved as their

advocates suppose, or that the legislators are not so wise as they should be. In this state of the case, admitting a great deal of corruption, ignorance, and error on the part of those who control the measures of the different civilized nations of Christendom, yet their general concurrence in rejecting these doctrines, even in those two or three countries where they are most confidently asserted and most learnedly inculcated, presents an authority against their practical utility quite as imposing as that of the professors by whom they are so strenuously advocated. This science, like other speculative sciences, commenced in theories; and the discussion and refutation of them still occupies a great share in the recent treatises—a circumstance which of itself shows that it is in rather a rude state, since in those sciences which have reached an advanced state the visionary systems of the first speculators are now mentioned as matters of mere historical curiosity, a formal confutation of which would be superfluous. Unless we should consider the notion of some ancient nations, that plunder was the great source of national wealth, as a theory in this science, the first step in political economy was the theory of the commercial or mercantile system, which taught that a nation could grow rich only by trade, and that its growing rich in this way depended on the balance received in the precious metals on adjusting its accounts with other nations. Neither of these views is entirely visionary, for a nation may gain wealth by carrying on either war or trade upon very advantageous terms. It is assumed, indeed, that all commercial exchanges are only those of equivalent values. But notwithstanding this axiom, an individual merchant or speculator will sometimes make his fortune by exchanging, or, in other words, by buying and selling. And so a nation, if it possesses some very great commercial advantage—like those of the early Spanish traders with the native Americans, who could exchange iron and bits of tin for a much greater weight of gold—may grow wealthy by trade; for the nation may in this way get, for what costs them only a day's labour, what would cost them, or what may be worth to them, five, six, or twenty days' labour. The mercantile system had therefore some foundation in fact and experience; for every one will probably admit that any particular branch of trade may be more or less advantageous to those engaged in it, and to the countries to which they belong, and that one branch may be more advantageous than another. It is said, indeed, that a disadvantageous trade will cease, and it is thence inferred that all those which continue to be carried on are profitable and useful. This is, at least, admitting that there may be a disadvantageous trade, and that some branches may be advantageous will not be disputed. The mercantile system, then, had some foundation; but, like some other theories of political economy, it was carried too far. The science of national wealth, as applied to nations generally, is reduced to very narrow limits, if we suppose it to rest wholly upon the bargains made in foreign barter. The mistake lay in magnifying the relative importance of foreign trade as a part of the causes of national industry and resources, since the annual profit derived thence, even in a very commercial country, does not usually exceed some very inconsiderable per centage of the whole annual production and consumption. But a still more objectionable part of this theory was the supposition that the gain thus derived depended wholly upon the balance received in gold and silver—according to which notion such a country as Mexico, a great portion of the exports of which are necessarily gold and silver, could never grow rich. The more it produced of the very articles the gaining of which alone could make other nations

rich, the more demonstrably impossible it was that it should grow wealthy itself. So far, therefore, as the theory referred national growth in wealth exclusively to the receipt of such a balance of trade, and made the growth in wealth proportional to the amount of this balance, it was entirely fanciful. This theory was supported in the latter part of the seventeenth and early part of the eighteenth century, in England, by Mr. Mun, Sir Josiah Child, Dr. Davenant, and Sir James Stuart; but it was called in question at the same period by Sir William Petty, Sir Dudley North, Mr. Barlow, and later by Sir Matthew Decker and Mr. Harris. Sir Matthew Decker's Essay on the Decline of Foreign Trade was published in 1744, and Mr. Harris' Essay upon Money and Coins in 1757. Hume treated of the same subject in his Political Essays, published in 1757. So far, then, as this theory rested upon the notion of a money balance as being the only source of national growth in wealth, it was ably discussed before the publication of Smith's Wealth of Nations. But the practical question at the bottom of the theory, namely, the national advantages and disadvantages of particular branches of trade, and the effect upon a nation of a trade which keeps it always in debt to another, has not been settled to this day; the economists of the *new school*, as it is termed, maintaining that all foreign trade is advantageous to a country precisely to the degree to which it is profitable to those engaged in it, and therefore that the immediate interest of the merchant, under the actual circumstances, is the infallible criterion of the national interest; while others, on the contrary, and with them most legislators, practically act upon the doctrine that the immediate interest of the merchant is not in all cases a criterion of the permanent national interest. See BALANCE OF TRADE.

The manufacturing system has been ranked as another economical theory; but it can hardly be regarded in this light. It supposes that a nation promotes its wealth and productive capacity by manufacturing for itself all those commodities for the manufacture of which it is adapted by its climate, agricultural pursuits, and the habits and character of its people. It is not now disputed that manufacturing will contribute to the aggregate value of annual products, as well as agriculture or commerce. The only questions are: 1. What descriptions of manufacturing industry will increase the productive resources of a particular country; and 2. Whether it should be an object of legislation to foster and promote these branches of industry. Those opposed to any such legislative interference—namely, the advocates of free-trade—assume that the national industry, left entirely free, and open to a competition with that of other nations, will infallibly take those channels by which its aggregate results will be the greatest. The foundation of the doctrine of the *let us alone* policy was laid by Adam Smith, since whose time its advocates have assumed it upon the principles by which it is supported in the Wealth of Nations. Smith rests the doctrine upon two propositions:—1. 'That every individual can judge, better than any statesman or lawgiver can do for him, what is the species of industry on which he can best employ his capital;' and 2. 'The study of his own advantage naturally, or rather necessarily, leads every individual to prefer that employment of capital which is most advantageous to society.' The doctrine of free-trade rests wholly upon these two propositions. Our limits will not allow us to consider the arguments in favour or against their soundness as the guides of legislation in all cases. For these the reader is referred to the works mentioned at the end of this article. It is sufficient to remark here

that the doctrine of free-trade, long merely a theory, has been practically adopted in Great Britain.

Another theory in relation to national wealth was that of Quesnay, denominated the *agricultural system*—namely, that agricultural is the only productive sort of labour, since this affords a surplus (to wit, rent) after paying the labourer; whereas, all other kinds only replace the value of the stock and pay the wages. This theory is, however, entirely exploded; and, besides, it is of a kind not calculated to do any practical injury; for no nation would think of legislating upon the assumption that, because the raising of cattle, and thus producing hides, was, according to this doctrine, a productive labour, and that of tanning the hides and making the leather into shoes was not productive, or left no net gain, therefore the two latter branches might as well be discontinued.

These doctrines refer to the general national industry and growth in wealth; others are partial in their application, of which we will notice a few that are adopted by those writers who are the most disposed to consider political economy a science. One of these doctrines, stated by Adam Smith, is, that the wages of common day labour finally fix at the point at which they barely afford the labourer the means of subsistence, and of continuing the race of labourers. This is called by the followers of Adam Smith the 'natural rate of wages.' It is usually assumed in their writings as settled. But it is not pretended that the wages of labour are the same in the different countries of Europe; on the contrary, it is everywhere taken for granted that they are higher in some countries than in others. It would follow from this doctrine that in those countries the necessary expense of supporting and reproducing the labourers is in proportion to the wages paid in them respectively; whereas the fact is quite otherwise. And what entirely confutes the notion of any such 'natural rate' of wages, is that the rate varies in different kinds of labour, in which the expense of supporting, instructing, and reproducing the labourers, is apparently equal. The very statement of this doctrine presupposes a natural rate of expenditure for shelter, clothing, and food, for the labouring classes, a supposition which has no plausibility in theory, and no support in fact. The doctrine of a natural rate of wages of the labouring classes is, indeed, entirely fanciful. It is very true that the present pecuniary interest of those who hire and those who are hired, is at variance, as well as that of those who buy and those who sell; and the party having the greatest advantage in either case will, generally speaking, use it; and, accordingly, where the labourers are poor, thriftless, and improvident, saving nothing, and being obliged to depend upon the earnings of the day for their food, they put themselves very much in the power of their employers. If to this be added a superfluity of labourers, and a want of employment for all, the advantage of the employers is increased, and the labourers will accordingly be reduced to a lower and lower compensation, until, perhaps, at length, the wages paid will not more than supply them with the poorest fare, and the meanest clothing and accommodations. But the degree to which they may be reduced by the operation of these causes will evidently depend upon the situation of the country, the demand at successive times for labour, in comparison with the supply of labourers, and, most of all, upon the character of the labourers themselves. To say that there is some point at which these circumstances are naturally balanced in all countries and all stages of economical improvement at which the 'natural rate' of wages is graduated, seems to

be a proposition too fanciful and vague to deserve the name of a theory. But such is the doctrine of some economists.

Another leading doctrine of Adam Smith and his followers grows out of the state of the English poor-laws. It is that all provision by law for the support of the poor is useless and injurious. This doctrine is fortified by Malthus's theory of population. See POPULATION.

A proposition dwelt upon at some length by Say, and carefully inculcated in many other writers on the science of economy, is, that production is not *creation*; that a farmer cannot make corn, nor a weaver cloth, out of nothing. M'Culloch says labour is 'the only source of wealth.' This is one of the doctrines of the economists, from which consequences of some weight are deduced. Now all will, without doubt, agree, that without any materials, or, in other words, without the *earth*, men would not produce wealth; and it may be conceded also, for the purpose of the argument, that the earth, without inhabitants, would have no wealth. But men, being placed upon earth, may produce wealth by working upon the materials supplied by it; and the earth is itself sold in portions as a part of the common stock of wealth, and the men are also sometimes themselves bought and sold, as being a part of the same stock. In general, two things must concur in order to the production of value, namely, the thing to be wrought or used, and a person to work or use it. To insist that one or the other is the exclusive *source* of value, seems to savour more of the obsolete metaphysics of the schools than of practical speculation. The utmost that can be made out of it is a merely verbal distinction. And one would hardly expect so trivial a subtlety to occupy much space in a branch of knowledge holding the rank of a science.

All writers agree in the doctrine that security of property is essential to the accumulation of the products of labour, that is, wealth, for no one will save what he has no reasonable assurance that he shall enjoy; and it is also agreed by all that accumulation, that is, a stock on hand, is necessary to the productiveness of labour.

Adam Smith lays great stress upon the division of labour, as one of the causes of the great productiveness of industry. His remarks upon this subject are just, with the qualification, perhaps, that he overestimates the importance of the principle, since he attributes to it the improvements made in various processes of industry, whereas many of the improvements are themselves the causes, or rather afford the means of a separation of employments. Any machine is an illustration of this remark.

It is asserted by some of the writers on this science, that there are no limits to the beneficial effects of the accumulation of capital upon the productiveness of the industry of a nation; or, in other words, that a given number of people, however small, can advantageously employ any amount of capital, however great. But if we assume a certain number of employments and professions, there is certainly a limit beyond which no additional stock and materials could be employed. The proposition may mean that the ingenuity of men can, or will, find out modes of employing advantageously any amount of capital that can be accumulated by them. The proposition thus stated is at least a theoretical one; but the inquiries and investigations to which it leads are certainly not sterile of useful results.

All the products of industry are divided among the persons by whom the taxes are received and consumed, the holders of sinecures, the capitalists,

and the labourers, including in this latter class all the industrious in all professions and pursuits. A great problem in political economy is to determine the mode of distribution most advantageous to the nation; and this problem, which is very general and very complicated in its details, has not yet been fully solved. It is generally agreed that all absolute sinecures, whether under the government or otherwise constituted, are prejudicial. What distribution among the usefully employed, or what comparative remuneration for the labour or services of the respective classes and professions, is the most advantageous, is a subject very little discussed by the writers on economy. But the question as to the distribution between the capitalists, who are entitled to profits, and those who labour upon or with the capital, who are entitled to wages, is a subject of considerable speculation in the books. One doctrine is, that where profits are highest, accumulation will be most rapid; that is, the greater the mass of the annual products that go to those whose capital supplies the materials and instruments of labour, the more rapid will be the growth in wealth. This is assuming that nothing will be saved by the labourers, or not so much in proportion as will be saved out of the profits. The first assumption cannot be made, and the second is questionable.

Economists generally agree in the definition of *value*, as being determined by the amount of marketable things for which an article can be exchanged. It is also well settled that demand determines the market value; but some assert again, or at least seem to imply, that value and cost are synonymous. They also generally imply, by the mode of using the term *cost*, that it is some definite, fixed quantity. This use of language throws great obscurity on their speculations on this subject, since the cost of producing an article varies from week to week by the variation of the price of the materials and the wages; and the same kind and quality of articles will, at the same time, cost one producer more than another. The proposition that cost regulates value is laid down by the writers with great solemnity, and inculcated at great length. It is a subject on which there certainly is a great deal of unprofitable prolixity in the books; for what argument or illustration is necessary to establish the proposition, that men will not continue long to produce an article by which they lose money? The proposition seems to stand in quite as great need of an apology for stating it, as of a disquisition to explain or support it.

Ricardo's theory of rent finds a place in most of the more modern treatises on political economy. Malthus and West first called attention to the fact that the land last brought into cultivation paid no rent, whereupon Ricardo founded the theory that rent resulted from the different productiveness of different soils, superiority of situation, and other differentiating causes, and that if there was no difference in the productive qualities of all the parts of the whole territory of a nation there would be no such thing as rent. His theory is controverted by Dr. Chalmers and others, but is still generally received by political economists. The result of Ricardo's theory of rent, which is most esteemed by the political economists of his school, is the elimination of rent from among the constituent elements of the cost of production.

Passing over what relates to consumption (which see), the above are some of the leading doctrines and theories of what is called the science of political economy as taught by recent writers in Britain and France, a science of which Adam Smith is said, by its professors, to be the founder. There are many useful truths which pass under the name of political

economy; but a large proportion of the treatises instead of following in the footsteps of Adam Smith, the true founder of the science, seem to bear the same relation to an intelligible practical development of the causes and phenomena of national growth, wealth, and decline that alchemy does to modern chemistry.

For other branches of political economy see BANK, BOUNTY, CURRENCY, CAPITAL, COLONY, COMMUNISM, COMMERCE, CONSUMPTION, CORN LAWS, CREDIT, DEBTOR AND CREDITOR, DEMAND AND SUPPLY, EXCHANGE, LABOUR, LOTTERY, MONOPOLY, PATENT, PHYSIOCRATICAL SYSTEM, RENT, VALUE, &c. The following are some of the principal works on political economy: Stewart's *Inquiry into the Principles of Political Economy* (three vols. London, 1767); Turgot, *Recherches sur la Richesse et l'Origine des Richesses nationales* (Paris, 1774); Le Trosne, *De l'Ordre Social* (Paris, 1777); Adam Smith's *Inquiry into the Nature and Causes of the Wealth of Nations* (two vols. London, 1776; new edition by M'Culloch); Say's *Traité d'Economie Politique*; Sismondi's *Nouveaux Principes d'Economie Politique* (two vols. Paris, 1818); Ricardo, *On the Principles of Political Economy and Taxation* (new edition, London, 1819); Malthus' *Principles of Political Economy* (London, 1820); Senior's *Lectures on Population* (1831); Henry Carey's *Principles of Political Economy* (three vols. Philadelphia, 1837-40); John Stuart Mill's *Principles of Political Economy* (two vols. London, 1848); Fawcett's *Manual of Political Economy* (London, 1869); Jevons's *Theory of Political Economy* (1871); Cairnes's *Leading Principles of Political Economy* (1874); Sidgwick's *Principles of Political Economy* (1883); Marshall's *Principles of Economics* (1890); Prof. J. S. Nicholson's *Principles of Political Economy* (3 vols. 1893-1901).

POLITICAL OFFENCES are those offences considered injurious to the safety of the state, or such crimes as form a violation of the allegiance due by a subject to the recognized supreme authority of his country. In the ancient times of the Roman Republic offences of this nature were comprehended under the name *perduellio*, and were considered equivalent to making war upon the state. The term was commonly applied to cases of a general betraying or surrendering an army to the enemy, to conspiracy against the state, attempts to obtain kingly power or aiding in any way the common enemy. Offenders were tried by two judges, called *Perduellionis Duumviri*, and if convicted were put to death by hanging, or by being thrown from the Tarpeian Rock; the accused had, however, the right of appeal to the people, in early times the *populus*, later the *comitia centuriata*, as was done by Horatius. In later times the term *perduellio* seems to have almost fallen into disuse, and the terms *majestas*, *crimen majestatis*, *crimen læsæ, imminutæ, diminutæ, or minutæ majestatis* were substituted. All those were guilty of *majestas* who effected, aided in, or planned the death of one having military command or civil authority; who lost an army, who excited sedition, or who by bad conduct in administration impaired the dignity of the state. Under the empire words or acts disrespectful to the emperor were included. In modern times the crimes considered political offences have varied at different periods and in different states. In England the most serious political offences are termed treason (which see), and those of a lighter nature, which do not aim at direct and open violence against the laws or the sovereign, but which excite a turbulent and discontented spirit which would likely produce violence, are termed sedition. (See SEDITION.) Political offenders of foreign countries are by English law not included in extradition treaties, and by the 33 and 34 Vict. cap. 111. (1870),

the secretary of state may if he sees fit order at any time a fugitive criminal accused or convicted of such crimes to be discharged from custody. In the United States also, and in most of the countries of Europe, the extradition treaties do not include the giving up of political offenders.

POLITICS, in its widest extent, is both the science and the art of government, or the science whose subject is the regulation of man in all his relations as the member of a state, and the application of this science. In other words it is the theory and the practice of obtaining the ends of civil society as perfectly as possible. In common parlance we understand by the politics of a country the course of its government, more particularly as respects its relations with foreign nations; and the more important these relations are (as, for instance, in European states, which exert so powerful an influence on each other), the more prominent is the place which they hold in the ideas conveyed by the word; whilst in kingdoms whose relations to foreign countries are comparatively unimportant, the word in common usage is naturally more confined to the principles and operation of the internal government. Politics, therefore, extends to everything which is the subject of positive laws, for it is by means of these that the purposes of a state or civil union are effected. The political relations of men have therefore always been the engrossing subject of history.

POLIZIANO. See **POLITIANUS**.

POLK, JAMES KNOX, President of the United States of North America from 1845-49, was born in 1795, in the county of Mecklenburg, North Carolina. His ancestors, whose name was originally Pollock, emigrated from Ireland early in the eighteenth century. Though his father was a farmer in moderate circumstances, the son was sent to be educated at the university of his native state, where he distinguished himself by his industry and talent, and more especially by his attainments in mathematics and the classics. He afterwards studied law in the office of Felix Grundy of Tennessee, a talented lawyer and statesman. He was called to the bar of Tennessee in 1820, and in 1823 became a member of the legislative assembly of that state. In 1825 he became a member of the House of Representatives at Washington, and immediately distinguished himself as a zealous democrat. He vigorously opposed the administration of President Adams; and on the presidency of his friend, General Jackson, became one of the firmest supporters of his party. In 1827 he was appointed a member of the committee on foreign affairs, and in 1832 a member of the committee of finance, when he protested at the head of the minority against the renewal of the bank privilege. For this reason he was strongly opposed by the supporters of the bank, who endeavoured to prevent his re-election for Tennessee; but he gained it by a large majority. In 1835 he was appointed speaker of the House of Representatives; and in the same post, during an extraordinary meeting of Congress, summoned by President van Buren, conducted himself with so much impartiality as to gain the approbation even of his opponents, and obtain a unanimous vote of thanks from the house. In 1837 he became speaker for the third time, and retained the office till 1839, when he was elected Governor of Tennessee. He now came forward as candidate for the office of vice-president, but owing to a reaction in favour of the whig, and in opposition to the democratic party, about 1841, both lost the election and was deprived of his governorship. He now retired into private life, till the democratical convention, held in Baltimore in 1844, invited him to offer himself as president. In the contest which ensued he signally defeated his distinguished

competitor, Clay. During his presidency the war with Mexico terminated, by the accession of New Mexico and California with its gold-fields to the United States territory, and the dispute with Great Britain as to Oregon was happily arranged. In 1849 he was succeeded by President Taylor, and in the course of the same year died at Nashville. His talents were by no means of the first order, but he was a good man of business, and was generally esteemed for his integrity.

POLKA, a favourite dance of recent times, of Bohemian or Polish origin, the name being derived from the Bohemian *pulka*, half, from the half step that characterizes the dance, or from *Polka*, a Polish woman. It was introduced at Prague about 1835, and in 1839 was brought by a part of the musical band of the Prague sharpshooters, under the management of Pergler, to Vienna, where both the music and dance met with extraordinary acceptance. In 1840 it was received with the greatest applause at the Odéon Theatre in Paris, and was soon the favourite dance at all the public and private balls of that capital. It spread rapidly into every country of Europe, and is now common in every part of the civilized world. The music is written in $\frac{2}{4}$ time, the first three quavers being generally strongly accented.

POLLACK, or **POLLOCK** (*Merlangus pollachius*), a species of Teleostean fishes, included in the sub-order Anacanthini, and belonging to the Gadidæ or Cod family. The Pollack forms a species included in the genus *Merlangus*, or that represented by the Whiting (*Merlangus vulgaris*); the members of this genus possessing three dorsal fins and two anals. The Pollack is sometimes locally known in Scotland by the name of Lythe. It is nearly related to and resembles in general shape the smaller and more familiar 'Podley' (*M. carbonarius*) or Coal-fish, which is caught in such quantities by the youths of every seaport town. The lower jaw is longer than the upper jaw, and the tail is forked, but not very deeply. The flesh of the Pollack is said to be inferior only to the whiting. It inhabits the Atlantic Ocean, and is common on all the British coasts, as well as on the shores of Norway. The northern coasts of Britain appear to be those on which these fishes are most abundant. The Pollacks are gregarious in habits and swim in shoals. They are caught with a variety of baits, but are most frequently captured with a white fly, or with a bait formed of any piece of white rag or other material; these fishes greedily seizing such objects. They are common in the Mediterranean in winter.

POLLAN (*Coregonus Pollan*), a species of Teleostean fishes, properly included in the family of the Salmonidæ or Salmon, but frequently and popularly referred to other divisions of the order Teleostei. This fish is sometimes popularly known as the 'Fresh-water Herring.' It is an Irish species, and is found in Lough Neagh, Lough Derg, and Lough Erne. The pollan was first described by Mr. W. Thompson as a distinct and separate species from others, occurring in Scotland at Lochmaben, and in the Cumberland Lakes. The name 'pollan' appears to be a local appellation. Large shoals of these fishes appear on the coasts of Ireland in spring, summer, and autumn, and these are captured by means of nets sometimes in immense numbers. In 1834 it is related that in a short period, and in three or four draughts of the net, 140 hundreds of these fishes—numbering 123 fish to the hundred, or amounting to 17,220 fishes in all—were readily taken. These fishes are sold in Belfast in the fresh state, and at the same time at which fresh herrings are sold in the streets and markets. The body of the pollan averages generally about 9 or 10 inches

in length. Two dorsal fins exist, the hinder dorsal being small and pointed. One anal fin is represented. In Loch Lomond a fish is caught called the 'powan,' or local fresh-water herring.

POLLARD, the name given to a tree the head of which has been lopped off about 8 or 10 feet from the ground, in order to induce it to send out bushy shoots, which are cut periodically for fuel, fencing, or other purposes. The pollard assumes a very formal shape, contrasting disagreeably with trees which have been allowed to assume their natural shape; and their round overshadowing tops in a hedge-row are very injurious to the crops of the adjoining fields. By selecting a leading shoot, and cutting away all the others, the pollard, if not too old, may be converted into an ordinary tree.

POLLEN, in botany, the powdery matter contained in the anthers of a plant, consisting of small cells developed in the interior of other cells. The cavities formed in the anther are surrounded by a fibre-cellular envelope, and within this are produced large cells containing a granular mass, which divides into four minute cells, around which a membrane is developed, so that the original cell (the parent pollen utricle) becomes resolved into four parts, each of which forms a granule of pollen. The four cells continue to increase, distending the parent cell, and ultimately cause its absorption and disappearance. They then assume the form of perfect pollen grains, and either remain united in fours or multiples of four, or separate into individual grains, which by degrees become pure pollen. Occasionally the parent cell is not completely absorbed, and traces of it are detected in a viscous matter surrounding the pollen grains. In Orchidaceous plants the pollen grains are united into masses or pollinia by means of viscid matter. Pollen grains vary from $\frac{1}{100}$ to $\frac{1}{200}$ of an inch, or less, in diameter. Their most common form is ellipsoidal, more or less narrow at the extremities, and their surface is often sculptured in various ways.

POLLENSA, a town of Spain, in the north of the island of Majorca, 28 miles north-east of Palma. It has good and well-paved streets, a town-house, hospital, asylum, prison, and primary schools; a fine Jesuits' college, partly ruinous, the church attached to which is one of the best of the class in Spain. The port and bay of Pollensa are a few miles north-east, defended by the castle of Albercuix. There are manufactures of linen and woollen tissues, charcoal, and soap. Pop. (1887), 9203.

POLLIO, CAIUS ASIINUS, a Roman of plebeian family, born B.C. 76, is known from the part he took in the political events of his time, but still more by his writings and love of literature. In the civil war he, B.C. 49, adhered to Julius Cæsar, whom, after defeating Caius Curius in Africa, he accompanied to Pharsalia, and then to the African and Spanish wars. He was afterwards appointed prætor, and held the government of Thither Spain, where he heard of Cæsar's murder, and fought, but without success, against Sextus Pompeius. When Lepidus and Antony were reconciled, in B.C. 43, he joined them with three legions, and proceeded as legate of the latter into Transpadane Gaul. At this time he became the friend of Virgil, whose property he saved from confiscation. After obtaining the consulship he commanded in Illyria and Dalmatia, and for his victories was honoured with a triumph B.C. 39. He afterwards devoted most of his time to literary pursuits, but acted both as a senator and an advocate till A.D. 4, when he died at his Tusculan villa at the age of eighty. He wrote speeches, tragedies, and a history of the civil wars, but hardly anything of his is extant. He was a great patron of literary men. Virgil addressed two Eclogues and Horace an ode to him. He founded

the first public library at Rome.—**CAIUS ASIINUS POLLIO**, surnamed Gallus Salonius, son of the former, became consul B.C. 8. He wrote a work which has been lost, drawing a comparison between the eloquence of his father and Cicero, and giving the preference to the former. He was murdered in the thirty-third year of our era, by Tiberius, who hated him for his freedom of speech, and also for having married Vipsania Agrippa, whom Tiberius had divorced for Julia the daughter of Augustus.

PÖLLNITZ, KARL LUDWIG, BARON, a writer of witty and interesting memoirs, was born at Issomün, near Cologne, in 1692. His father's position as minister of state to the Elector of Brandenburg, and his own brilliant accomplishments procured him admission to courtly circles; but his restlessness, extravagance, and profligacy soon brought him into difficulties, and reduced him to the condition of a soldier of fortune. He served successively in the Austrian, Papal, and Spanish armies; but failed in obtaining any profitable appointment. At last he attracted the favourable notice of Frederick the Great, who appointed him his reader, and afterwards director of the theatre at Berlin. After having from interested motives twice gone over from Catholicism to Calvinism he proclaimed himself a member of the Romish Church shortly before his death, which took place in 1775. Among the literary works ascribed to him are *La Saxe galante*, which brought him most fame; but which was afterwards discovered to be a bare-faced plagiarism, of the joint production of Larochefoucauld and Mme. La Fayette, entitled *La Princesse de Clèves*; his amusing *Lettres et Mémoires, et la Relation de ses premiers Voyages; État abrégé de Saxe sous la régence d'Auguste II.* (Frankfort, 1734); *Histoire secrète de la Duchesse d'Hanovre, épouse de George I.* (London, 1782); and a posthumous work brought out by Brunn, *Mémoires pour servir à l'Histoire des quatre derniers Souverains de la Maison de Brandebourg* (two vols. Berlin, 1792).

POLLOK, ROBERT, a Scottish poet, was the son of a farmer in the parish of Eaglesham, Renfrewshire, and born there in 1798. Having shown a decided predilection for literary studies, it was resolved to educate him for the ministry, and accordingly, after attending the University of Glasgow, he entered the divinity hall of the Secession Church, under Dr. Dick, and was licensed as a preacher by the Associate Presbytery of Edinburgh in the spring of 1827. In early youth he had made various attempts in prose and verse, including three tales on the persecutions of the Covenanters, which were published anonymously. Just before receiving his license to preach he had completed his poem of the Course of Time, comprising ten books in blank verse, and describing the history of the human race, as supposed to be narrated by a celestial bard to a wanderer from one of the worlds in space. It displays undoubtedly considerable fervour of language, and the tribute may certainly be accorded of great earnestness of purpose, expressed in language which, if not majestic, is at least chaste and solemn. But it is sadly deficient in imaginative power; and many of the reflective passages, which engross a large part of the work, suggest strongly the idea of sermons rendered into blank verse. By some of his warmest admirers Pollok was raised to the level of, and even made to occupy a more exalted position than Dante or Milton. The author, however, never lived to enjoy the homage which his work called forth, the excitement and labour of composing it having brought on consumption. Shortly after its publication decided symptoms of pulmonary disease began to manifest themselves; a removal to Italy was recommended; and the same

rous friends whom his talents and virtues had secured for him were ready to provide the means for effecting this object. But his strength was unable to undertake so lengthened a journey, and he accordingly proceeded no farther than Southampton, taking up his abode at Shirley Common, in the neighbourhood of that town. Here he peacefully expired on the 18th September, 1827, and was interred in the churchyard of Millbrook, where a monument has been erected over his grave. A life of him was published by his brother in 1843. A great many editions of his *Course of Time* have been published, both in Great Britain and in America.

POLLOKSHAWS, a police burgh and town of Scotland, county of Renfrew, 2½ miles south-west of Glasgow, on the White Cart, and on the Glasgow, Barrhead, and Kilmarnock and the Cathcart District Railways. The railways, along with the tramway-car system, afford ready communication with Glasgow at all hours. The manufactures of cottons, earthenware, iron-founding, boiler-making, engineering, paper-making, dyeing, and bleaching employ many hands. Pop. (1891), 10,228; (1901), 11,169.

POLL-TAX, a tax levied on all members of the community, the very poorest excepted, the same as capitation tax. (See *CAPITATION*.) This tax was first levied in England in 1377 and 1380, to defray the expenses of the French war; its collection in 1381 led to the insurrection of Wat Tyler. The amount payable was three groats for each person, male and female, above fifteen years of age. The tax was farmed out to tax-gatherers in each county, who levied the money with great rigour. The first disorder was raised by a blacksmith in a village of Essex, whose daughter had been insulted by the collector. The father dashed out the ruffian's brains with his hammer; the by-standers applauded the action, and exclaimed that it was full time for the people to take vengeance on their oppressors. The rebellious spirit soon spread into the counties of Kent, Hertford, Surrey, Sussex, Norfolk, Cambridge, and Lincoln, and in a short time 100,000 men, under leaders known in history as Wat Tyler, Jack Straw, Hob Carter, &c., marched upon London. After some hesitation the king (Richard II.) agreed to hold a conference with Tyler, who is said to have drawn his dagger in the king's presence, an act which cost him his life. He was struck down by Walworth, mayor of London, and his followers dispersed at some fair words addressed to them by the king, and a promise that slavery should be abolished, that there should be freedom of commerce in market towns without toll or impost, and a fixed rent on lands instead of the services due by villinage, together with a full pardon for all concerned in the rising. This promise was very badly kept; many of the rioters were put to death without the form of a trial; the charters of enfranchisement were revoked by Parliament, and the people were reduced to the same miserable condition as before. The hearth-money of the reign of King William III. was virtually a poll-tax, and was equally unpopular, though it led to no outbreak.

POLLUX. See *CASTOR* and *POLLUX*.

POLLUX, JULIUS, a Greek sophist and grammarian, born at Naucratis, Egypt, about the year 135 A.D. He went to Rome during the reign of Marcus Aurelius, and rapidly acquired so considerable a reputation that that emperor appointed him one of the preceptors of his son Commodus. He wrote several works, all of which have perished except his *Onomasticon*, dedicated to Commodus, and therefore published before 177. Each of the ten books into which this work is divided forms a separate treatise by itself, and contains the most important words relating to certain subjects, with short explanations

of their meaning. The words are not arranged alphabetically, but are given with little regard to rigorous system of any kind, according to the subjects treated of in each book. The best editions are those of Lederlin and Hamsterhuis (Amsterdam, 1706), Dindorf (Leipzig, 1824), Bekker (Berlin, 1846).

POLO, GASPAR-GIL, a Spanish poet, born at Valencia about 1517. His inclination for poetry led him to abandon the profession of law, and his first works placed him among the best Spanish poets of his time. His reputation was established by his *Diana Enamorada*, a pastoral romance, partly in prose and partly in verse, intended as a continuation of the *Diana* of Montemayor. In invention Gil Polo is not inferior to his predecessor, whom he surpasses in purity of style, and in the harmony and brilliancy of his verse. He died in 1572. Cervantes excepts the *Diana* of Gil Polo from his list of works condemned to be burned. It ran through nine editions in fifty years, and has been twice translated into French and English, and once into Latin.

POLO, MARCO, the celebrated Venetian traveller, was born about the year 1256. His grandfather, Andrea Polo, a patrician of Venice, and of Dalmatian descent, had several sons, who, according to the prevalent custom of the republic at that time, devoted themselves to commerce—Marco, called *Il Vecchio*, to distinguish him from his nephew the traveller, settled in Constantinople, and had also a commercial establishment at Soldaya, or Soudach, on the Black Sea; Nicolo (the traveller's father), and Matteo, often incorrectly called Maffeo. The two latter shortly before Marco's birth set out on a mercantile expedition, visiting Constantinople, Soudach, and Bolghara (Bulgar) on the Volga, the capital of Barkai, Khan of Kiptchak. After a year's sojourn in this city they travelled round the north coast of the Caspian to Bokhara, where they were obliged to remain three years. At last, meeting with some ambassadors from Hülagh, the Mogul khan of Persia, to Kúblai, or Kúblai (which see), the khagan or grand-khan of the Mongols, the brothers were induced to accompany them to Kemeufu, on the frontiers of China, the summer residence of the Mongol emperor. There they were favourably received by Kúblai, who eagerly questioned them regarding the rulers, peoples, forms of government, military tactics, and administration of justice of Europe. The reports of the two Polos incited the khan to send them, accompanied by one of his own nobles, on a mission to the pope, bearing missives requesting his holiness to send him 100 wise men skilled in the arts and sciences, and well versed in matters of religion, to instruct, and if possible convert, the Mongols to Christianity. In 1268 the brothers set out on their return journey, but had to leave behind them their companion, who fell ill by the way, and they arrived at Venice in 1269. They found the Papal chair vacant, and after waiting two years in vain for the election of a new pope, and finding it impossible to carry out the mission with which they had been intrusted, they set out for the East again, this time accompanied by the young Marco. They passed through Palestine, and in Armenia were overtaken by messengers from the newly elected pontiff, Gregory X., who brought them presents and letters for the khan. After a journey of three and a half years they reached the court of Kúblai, who received them with all the pomp and circumstance characteristic of an oriental potentate. Marco rapidly learned the language and customs of the Mongols, and became a special favourite of the khagan, who, on account of the noble port and powers of observation displayed by the young Venetian, employed him on various missions to several of the neighbouring princes. Marco conducted himself so well on these occasions,

and gave his master such vivid narrations of his experiences of the courts and peoples he had visited, that he soon rose to higher distinction. The northern provinces of China, Western Tibet, the city of Lassa, then the seat of an active commerce, and the province of Khorasan, were visited in succession by the young adventurer, who generally found the khan's favour a passport to the most secret and sacred places. He was also employed to assist in drawing up an inventory of the archives belonging to the court of the Song dynasty; and soon afterwards was made governor of the important city of Yang-tchou, in Eastern China, an appointment he held for three years. He accompanied a Mongol army in its advance upon the Kingdom of Pegu, and subsequently went on an embassy to Tsiamp, the modern province of Saigon, in the south of Cochin-China, now in possession of the French. After passing seventeen years in the service of the khagan, the three Polos were commissioned to accompany the escort of Cogatra, a Mongolian princess travelling to Persia. They set out in 1292, travelled through China, and sailed through the Chinese Sea and Indian Ocean, experiencing numerous hardships on the voyage, and arrived at Teheran, where they remained for some time. Hearing that Kúblai Khan had died in their absence, they resolved to return home, and reached Venice in 1295, loaded with wealth and jewels, but so altered in appearance, and speaking their mother tongue with such difficulty, that it was long before they could convince their friends of their identity. Marco Polo equipped a galley at his own expense and took part in the naval battle of Curzola in 1298, in which the Venetians under Dandolo were defeated by the Genoese under Doria, and during which Marco Polo was taken prisoner. During his captivity he dictated to a fellow-prisoner, Rusticiano of Pisa, with the aid of the memoranda he had taken during his journeys, an account of all his travels, which was finished in 1298. After his liberation he returned to Venice, where he was appointed a member of the grand council, which position he held until his death in 1323. His book created an immense sensation among the scholars of the time; many, however, did not hesitate to characterize it as pure fiction, and even on his death-bed the author was implored to retract his alleged falsehoods, but he solemnly reaffirmed all his statements. The reports of Catholic missionaries and of subsequent travellers confirmed great part of his narrative; and in the course of time the good faith, talent, and quickness and accuracy of observation of the great traveller began to be recognized. Polo seems to have been remarkably careful in his statements; what came under his own eyes and what he had on testimony are duly noted in his work. It has now been almost settled beyond doubt that his narrative was first written and published in French. It was published in Latin and Italian during Marco's lifetime. It made known to Europe the existence of many nations of which they were formerly totally ignorant, such as Japan (called by Polo Zipangu), &c.; created a passion for voyages of discovery, which resulted in the Portuguese finding a way to India by doubling the Cape of Good Hope, and in the discovery of the New World by Columbus, a close student of the book. It has gone through numerous editions in the various European languages; the best Italian edition is that entitled *Il Milione di Messer Marco Polo Veneziano*, edited by Count Baldelli (four vols. 4to, Florence, 1827). Recent and excellent editions have been edited by G. Panthier (two vols. 8vo, Paris, 1865) and by Colonel Yule (*The Book of Ser Marco Polo, the Venetian*; two vols. London, 1871; 2d edition, 1875).

POLONAISE is a Polish national dance, which has been imitated, but with much variation, by other

nations; also the tune to which it is danced. The *Polonaise*, in music, is a movement of three crotchets in a bar, characterized by a seeming irregularity of rhythm, produced by the syncope of the last note in a bar with the first note of the bar following, in the upper part or melody, while the normal time is preserved in the bass. Movements of this sort, called by the Italians *Alla Polacca*, were once so popular that scarcely a single concerto was written without one being introduced into it.

POLOTZK (ancient *Peltiscum*), a town in Russia, in the government of Vitebsk, and 60 miles w.n.w. of the city of that name, situated on the right bank of the Dwina, and both banks of the Polotka. It has some fortifications of no great strength, particularly a castle somewhat dilapidated, which was built by Stephen Bathory, king of Poland, in the sixteenth century; and numerous churches and monasteries, but most of the houses are old and very indifferently built. The most remarkable edifices are the old Jesuit convent and college. It has some trade in flour and hemp, which is sent to Riga, and tanning is carried on to some extent. The town is one of the oldest in Russia, having been founded in the ninth century. A battle took place here between the Russians under Wittgenstein and the French under Oudinot in 1812, in which the latter were defeated. Pop. (1891), 20,105.

POLTAVA, or **PULTAWA**, a government of Russia, bounded on the north by Czernigov, on the east by Kharkov, on the south by Ekaterinoslav and Kherson, and on the west by Kiev; area, 19,265 square miles. It consists of an extensive and somewhat monotonous flat, highest in the north-east, and gradually declining to the south-west, where the Dnieper flows along its south frontier, and directly or by its tributaries the Sula, Piscol, Vorskla, and Orel, receives the drainage of all its surface. It is one of the most fertile and best cultivated portions of the Russian Empire, and exports about a fourth of its whole produce of wheat, oats, and barley. The meadows are both extensive and luxuriant, and the breeds of the immense herds of cattle and flocks of sheep which graze there are in general of a superior description. The rearing of bees is an important branch of rural economy. Both manufactures and trade are of very limited extent. The former are almost confined to woollens, leather, saltpetre, and brandy; the latter consists chiefly of agricultural produce, including horses and cattle, hemp, flax, tallow, wool, honey, and wax. Education, nominally under the superintendence of the University of Kharkov, is miserably neglected. Poltava is divided into fifteen districts. Pop. (1897), 2,794,727.

POLTAVA, or **PULTAWA**, a town of Russia, capital of the above government, on the Poltava, 445 miles s.s.w. of Moscow. It is walled, defended by a citadel crowning a small height, which rises up near its centre, and has spacious and regular streets; houses generally of wood, though some are of stone and brick. The trade, chiefly in cattle, corn, hemp, and wax, is very considerable; and the fairs, three in number, are very important. Under its walls in 1709 Peter the Great, at the head of the Russians, signally defeated the Swedes, under Charles XII. A monument in the principal square commemorates the victory; and 3 miles from the town is the tomb of those who fell in the battle, over which Peter set up a wooden cross, and which is still called the Swedish Tomb. Pop. (1897), 53,060.

POLYANDRY (from the Greek *polus* or *polys*, many, and *anēr*, *andros*, a man) denotes the custom of one woman having several husbands at one time. This system appears to have its stronghold in Tibet, in the valleys of the Lower Himalayas, in some valleys of Cashmere, and farther south among the Coorgs of

Mysore and the Nayers of Malabar. In these regions a wife generally belongs to the brothers of one family, the elder brother being the chief husband and the reputed father of the progeny. The custom has been found prevailing on the north coast of Ceylon, among the New Zealanders (though there nearly obsolete), in several of the South Sea Islands, some parts of Africa, among the Saporogian Cossacks, and, according to Humboldt, among the tribes of the Orinoco. There can be little doubt but that this peculiar system originated in the disparity in numbers between the sexes caused by the practice of female infanticide common among wild warlike tribes, who look upon woman as an incumbrance rather than as a helpmate. Polyandry anciently existed in some parts of Media and among the Picts. See POLYGAMY.

POLYANTHUS, a variety of the common primrose (*Primula vulgaris*), a native of most parts of Europe, growing in woods and copses in a moist clayey soil. The leaves are obovate, oblong, toothed, rugose, and villous beneath. The umbel is radical, and flower-stalks of the length of the leaves. The tests of a fine polyanthus are, a strong, erect, and elastic stem; the tube of the corolla above the calyx should be short, well filled with the anthers, and should terminate fluted, rather above the eye or middle circle. This should be round, of a bright clear yellow, and distinct from the ground colour. The ground colour is most admired when shaded with a light and dark rich crimson, resembling velvet, with one stripe in the centre of each division of the limb, bold and distinct from the edging down to the eye, where it should terminate in a fine point. The pips should be large, quite flat and round, as much as is consistent with their peculiar figure, which is circular, with the exception of those small indentures between each division of the limb, marking it out into five or six heart-like segments. The edging should resemble a bright gold lace, bold, clear, distinct, nearly of the same colour as the eye and stripes. The polyanthus is propagated by dividing the roots, which are perennial, or by slips; and for procuring new varieties by sowing the seed of the approved sorts. The seed should be gathered about the last week of June, and in ten days afterwards sown in boxes in the open air with a northern exposure. In July the plants are to be placed in open beds, and must be sheltered from the sun and watered for some time. Some will show flowers the same autumn, and many in the following spring. They require to be transplanted every two years. The best soil is a light loam, with a considerable proportion of sand, a small quantity of rotten dung, and a little leaf mould or peat earth. The plants are very hardy, and seldom die even in the most ungenial seasons. In the heat of summer, however, they are liable to be destroyed by snails and slugs, and by a small red spider.

POLYBIUS, a Greek historian, was born at Megalopolis, in Arcadia, about 204 B.C. His father, Lycortas, was one of the leaders of the Achaean League, and the confidential friend of Philopomen. Educated for arms and political life he was chosen, at the age of twenty-four years, as a member of an embassy to Ptolemy Epiphanes, but he did not leave Greece, as the embassy was abandoned. When the war between Perseus, king of Macedonia, and the Romans broke out, Polybius was sent to the Roman consul Marcus to inform him of the resolution of the Achæans to join him with their forces. He remained some time in the Roman camp, and then returned with a commission from Marcus to oppose the demand made by the commander Appius for more auxiliary troops to be sent to Epirus. About this time the design of the Romans to make all the free states of Greece dependent became evident, and

Polybius took part in all the measures for the preservation of their independence. When, therefore, after the subjugation of Perseus, the Romans used less disguises, Polybius found himself among the 1000 hostages whom the Achæans were obliged to deliver up to the Romans. His learning, virtues, and talents soon gained him the favour of some of the most distinguished senators, especially Fabius and Scipio, the two sons of Paulus Æmilius. The hostages were not dismissed until seventeen years had elapsed, when Polybius, who did not wish to see again his degraded country, remained in Rome, and entered into the service of Scipio Æmilianus. He accompanied him on his expedition to Africa, and was a witness of the destruction of Carthage in 146. Directly after this he went to Greece, where the Achæans had become involved in a war with the Romans. He is said to have been present at the capture of Corinth by Mummius (146); but this is doubtful. On the defeat of the Achæans he used all his influence to mitigate the fate of his countrymen. Achaia was now converted into a Roman province. Amid these melancholy occurrences he preserved his patriotism and disinterestedness. He executed, to the satisfaction of both the Romans and Greeks, the difficult commission of introducing the new form of government in the cities of Greece. The people of Achaia erected statues to him, one of which had this inscription:—'To the memory of Polybius, whose counsel, had it been followed, would have saved Achaia, and who consoled it in its adversity.' He is believed to have attended Scipio to Spain in 134, and to have been present at the siege of Numantia (133), but after the death of his great friend and benefactor, he returned to his native land, where he died in consequence of a fall from a horse, about B.C. 122.

Polybius is the author of a historical work from the beginning of the second Punic war (220) to the overthrow of Grecian independence (146 B.C.) It consisted of thirty-eight books, besides two introductory books, containing a sketch of the Roman history from the taking of Rome by the Gauls. Although the affairs of Rome are the chief subject, contemporary occurrences in other countries are also related, on which account Polybius gave it the title of a universal history (*historia katholiké*). We have of this great work only the first five books entire, and valuable fragments of the remaining books. Some of these fragments, as that containing an account of the Roman army, are of considerable length. The loss of the rest is very much to be regretted, as, in accuracy and fidelity of narration, and in extent of political and military knowledge, Polybius is surpassed by no historian of antiquity. To him is also attributed the introduction of didactic politics into history—that is, of that manner of writing history which, by intermingling views of the causes, occasions, and effects of events, is a useful introduction to politics. On the other hand, his style is destitute of beauty, and the narrative interrupted by lengthy digressions, which weaken the artistic effect. Livy was much indebted to Polybius after he came to the Second Punic war. Cicero mentions a particular work of his on the Numantian war. The most valuable editions of Polybius are those of Casaubon (Paris, 1609), of Jac. Gronovius (Amsterdam, 1670, three vols.), republished by J. A. Ernesti, with Casaubon's Latin translation and a commentary (1764), and those of Schweighäuser (1789), Bekker (1844), L. Dindorf (four vols. 1866-68), and Hultsch (four vols. 1867-71). The history of Polybius has been well translated into English by E. S. Shuckburgh (1889).

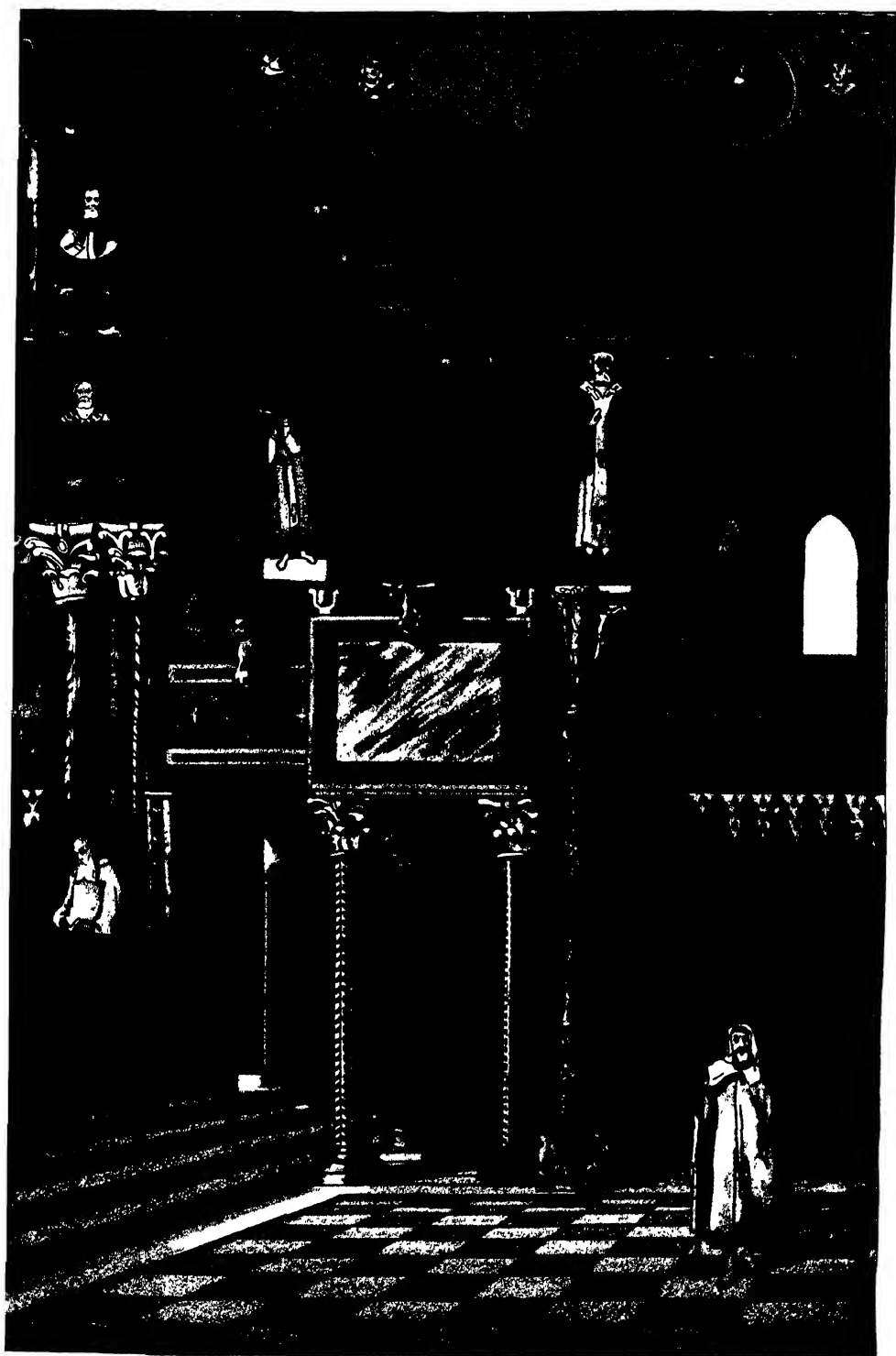
POLYCARP, a Christian 'father,' according to his disciple Irenæus a disciple of the apostle John, born probably about A.D. 69. According to a legend—

POLYCHROMY-I.



Drawn by De laet

GRECIAN ARCHITECTURE AND SCULPTURE.



ary fragment ascribed to a writer named Pionius, he was brought up by a noble Christian lady named Callisto, and was consecrated by St. John to the bishopric of his native city. When the controversy about the celebration of Easter began to run high he went to Rome to confer with Anicetus, who then occupied that see; and though he did not succeed in reconciling the differences between the Eastern and Western Churches, the questions were discussed in the most amicable manner. During the persecution under Marcus Aurelius he was seized and carried before the Roman proconsul at Smyrna. He was urged to revile Christ, but he replied, 'Eighty and six years have I served him, and he has done me nothing but good, and how could I revile my Lord and Saviour.' The people destined him to the wild beasts, but the judges condemned him to the flames. These, however, according to the legend, played harmlessly around him, in the shape of a swelling sail, and emitting a sweet fragrance. Seeing his body to be proof against the flames the judges ordered one of the executioners to run him through with a sword. A white pigeon suddenly flew up, and the flames were extinguished by the blood that flowed from the wound. This tradition, which probably contains some truth with a mixture of fable, has been turned to good account in one of the works of Herder. Polycarp is one of the saints in the calendar of the Roman Catholic Church, and the 26th of January has been consecrated to his memory. He wrote several letters, which were current in the early church, but have all perished except one addressed to the Philippians.

POLYCHROMY, a compound of two Greek words, signifying 'many colours,' is the name given to the art of decorating works of sculpture and architecture with different colours. The custom of painting statues is as ancient as sculpture itself; the Indians, Assyrians, Egyptians, Phœnicians, Babylonians, and Persians all painted their statues in various colours, especially in red, and further decorated them with plates of gold, silver, or ivory, besides adorning them with precious stones, and chains of gold and silver. But so far as we can judge from the rare specimens of the painted statues of those ancient peoples, polychromy had not reached the dignity of a real art; this it first attained only among the Greeks. From the remains of the tomb of Mausolus (see MAUSOLEUM) now to be seen in the British Museum it is to be inferred that a part of that monument was adorned with various colours; the statue of Mausolus was painted vermilion as well as the figures of personages on a bas-relief whose ground appears to have been painted blue. But it is open to question whether those figures may not have been painted long after the erection of the monument, at a relatively recent period, as the tomb was not destroyed entirely until the fifteenth century. In the National Museum at Naples a marble Apollo, which appears to be a Greek production, bears faint traces of colour, the hair being painted of a golden tinge, the pale blue drapery being adorned with a red band dotted with white flowerets. In the same museum may be seen a statuette representing the goddess Isis with the hair and a part of the drapery gilded. From an inscription found during the excavation, we learn that this statue had been placed in the temple of Isis at Pompeii by L. Cœlius Phœbus by decree of the decurions. In the Glyptothek at Munich a statue of Leucothes has traces of gilding in the hair, and of red and green colour in the drapery. In the noblest epoch of Greek art polychrome sculpture underwent a complete change. Instead of employing colours the sculptors of the age of Pericles used marble of different colours fitted together, and the ornaments of those statues were made of various

metals, and of ivory. Thus the nude parts of the figure were in some cases of Parian marble, the draperies of streaked onyx, the eyes of gold or ivory, the shields and other arms of bronze, and so forth.

Polychromy as applied in architecture may be divided into *natural polychromy*, which consists in the employment of materials producing certain effects by their natural colour; and *artificial polychromy*, which is simply the application of coats of paint to the various parts of the edifice, whether on the exterior or the interior. Both natural and artificial polychromy, the first having precedence in point of time, were used by the Assyrians, Babylonians, Persians, Egyptians, and, though this was a subject of doubt and even denial up till the beginning of the present century, by the Greeks. Plutarch in his Life of Themistocles informs us that one of the statues of the temple of Minerva in Eubœa was coloured saffron by means of a coating of which milk formed a constituent. We learn from Pliny that certain parts of the walls of the temple of Olympus were coloured with an analogous composition, and that for several centuries those walls retained their yellow tint. According to Pausanias the balustrade surrounding the Olympian Jupiter of Phidias was painted blue. The same author also tells us that several courts in Athens were painted, some green and others red. In some of the temples all the various parts of the buildings were detached by different tints, bringing out more clearly the effect of each member of architecture. Friezes, metopes, the bottoms of pediments, mouldings, cornices, &c., were covered with coats of fine plaster or stucco of various colours harmoniously combined, when the material was ordinary stone; when in marble the colours were applied without any medium. Our first plate shows a group of objects illustrating polychromy as applied by the Greeks in sculpture and in architecture.

The Romans, following the example of the Greeks, cultivated polychromy, but in a much more restricted style. We find it employed in statuary in the bust of Antinous (now in the Louvre), which was formerly lightly coloured and had eyes of precious stones inserted, like several sculptures of the same character found in Herculaneum and Pompeii. In the department of architectural polychromy we find in the last-named cities pillars and the inner and outer walls of buildings painted in various colours. (See plate at POMPEII.) Trajan's pillar at Rome was remarkable for the brilliancy and taste with which it was coloured. In the public and ornamental buildings of the later Romans gold decorations and facings of variegated stone appear to have been used instead of mere colours. In the middle ages polychrome architecture was adopted both by the Arabs and the Byzantines. In the tenth century gilded capitals and alternating variegated layers of stone again make their appearance. One of the finest examples of the Byzantine ecclesiastical architecture in the polychrome style is the Palatine Chapel at Palermo, erected by King Robert of Sicily in 1132, of the interior of which we give a view.

On the establishment of Gothic architecture polychromy was introduced into the interior of churches as one of the essential parts of a regular system. The foliage of capitals was gilded, the ground painted red, the ribs of arches and mouldings were decorated with gold and red or gold and blue, and even the plain surfaces of the arches were covered with a lighter tint of the same colours; altars, also balustrades, pulpits, sacramental tabernacles, &c., were painted on the ground and gilded on their projections. This practice maintained its place throughout the whole period of the middle ages, but in most churches sub-

sequent whitewashings have effaced all traces of it. In the period of the renaissance painting and gilding gradually ceased. The middle-age sculpture in wood and stone was at first, indeed, connected with painting, at least in statues not intended to stand in the open air. But the polychromy of the middle ages appears to have been entirely different from that of the Greeks, both in illusion and in reality. In the former not only were the draperies painted with the greatest and most varied splendour, but the hair and flesh were made to wear their true and natural colours, as may be seen in the famous statues of the Apostles in the choir of Cologne Cathedral. The broken light transmitted through painted windows tended, however, very much to diminish this effect, and is still one great obstacle to the progress of the taste for polychromy.

POLYCLETUS of **SICYON**, one of the most celebrated of the Greek sculptors and architects. He was a pupil of the Argive statuary Ageladas, under whom Phidias at that time was also learning his art. He flourished about 452–412 B.C. As a sculptor he stood at the head of the schools of Argos and Sicyon, and is regarded as the most successful rival of Phidias, the head of the Athenian school. The latter was considered unsurpassed in his statues of the gods, and Polycletus in those of men. He excelled particularly in representing the graceful attitudes of the gymnastics of youth. One of his most celebrated statues was the Doryphorus (Spear-bearer), a youthful figure to which the name of *canon* or model was given, as in it the artist had given a perfect representation of the ideal of the human form. His statue of Hera (Juno), in the temple between Argos and Mycenæ, was thought by Strabo to be equal to Phidias's chryselephantine statues of Zeus and of Athena. The Olympian Queen was seated on a throne, crowned with a garland on which were wrought the Graces and the Hours; in one hand she held a pomegranate, and in the other a sceptre surmounted by a cuckoo. The head, breast, arms, and feet were of ivory, and the robe which covered the figure from the waist downwards was of gold. As an architect he distinguished himself specially by the theatre and rotunda at Epidaurus, which Pausanias pronounced to be the finest buildings of their kind ever erected by Greek or Roman artists. Polycletus also wrote a treatise on the proportions of the human form.

POLYCOTYLEDONOUS PLANTS, in botany, the term applied to those plants of which the embryos have more than two cotyledons or seed-lobes.

POLYCRATES, tyrant of Samos during the time of the elder Cyrus and Pythagoras. The Samians had till then been free, but with the assistance of his two brothers Pantagnotus and Syloson he made himself master of the island by violence, and endeavoured to secure supreme and sole power by every means, even by the death of one of his brothers and the banishment of the other. Having secured absolute sway, he proceeded to strengthen the city, enlisted 1000 archers, equipped 100 galleys, and seized upon several of the neighbouring islands, and even some towns on the mainland. He formed an intimate alliance with the Egyptian king Amasis. His extraordinary success in all his undertakings induced Amasis, as Herodotus says, to admonish him to avert greater calamities by some voluntary sacrifice. Polycrates followed this advice, and cast his most valued jewel, a precious signet-ring, into the sea, which was, however, found a few days after in the maw of a fish that had been sent to him as a present on account of its remarkable size. This induced Amasis to renounce his alliance. When he was on the point of making himself lord of all Ionia and the neighbouring islands, the Persian satrap Oroetes, who considered himself

injured by him, treacherously invited him to his palace, and crucified him (B.C. 522). Polycrates seems to have had much taste for learning and the arts, and greatly promoted the refinement of the Samians. Anacreon, his favourite, and the celebrator of his fame, lived at his court.

POLYCYSTINA, the name originated by Ehrenberg, and applied to a family or group of Protozoa (which see) included in the order Radiolaria of that sub-kingdom. These organisms, all of microscopic or minute size, are allied to the better-known Foraminifera, which form huge fields of life in the depths of existing oceans, and which in past ages of the earth's history have been consolidated to form chalk-rocks. The shells of the Polycystina are, however, composed of siliceous or flinty material; those of the Foraminifera being formed of calcareous or limy matter. Through holes or apertures (*foramina*) in the siliceous shells, the sarcodematter of which the primitive bodies of the Polycystina are composed, is protruded in the form of elongated ray-like processes or filaments named *pseudopodia*. The shell itself is frequently provided with spinous processes, and several of the shells of this group exhibit a remarkable regularity and mathematical beauty of outline and figure. Movements of granules or solid particles can be discovered taking place along the borders of the pseudopodia. The sarcodematter of the bodies of Polycystina is of a brownish colour, and appears to contain yellow globules of various sizes. It does not generally fill the entire shell, but is limited to the upper portion of the structure, and exhibits also a division into four parts or lobes of equal size.

The Polycystina inhabit the sea-depths, and their shells mingle with those of Foraminifera and allied organisms to form the organic deposits which are continually being formed in the ocean-beds. Their distribution in time appears to have been of a more extensive nature than their present or geographical distribution. They are abundantly represented as fossil organisms, but are most familiarly represented in the deposit known as the 'infusorial earth' of Barbadoes, which belongs to the tertiary or recent period of geology. They also occur in rocks of mesozoic age, but are wholly wanting in the formations of the oldest or palæozoic period.

POLYDEUCES, or **POLYDEUKES**, the Greek name of Pollux. See **CASTOR AND POLLUX**.

POLYGAMY consists in a man's having more than one wife at the same time. It was common among the barbarous nations of antiquity, with the exception of the Germans, who, as Tacitus observes, 'prope soli barbarorum singulis uxoribus contenti sunt.' He says elsewhere, however, that their chiefs had the right of marrying several women at the same time. Among the ancient Britons there was a singular kind of polygamy. Any number of men joined in a society together, as was perhaps requisite for mutual defence. In order to link this society closer they took an equal number of wives in common, and whatever children were born were reputed to belong to all of them, and were accordingly provided for by the whole community. The ancient Medes compelled the citizens of one province to take each seven wives, and the women in another to have each five husbands, according as war had made extraordinary havoc in one quarter of their country among the men, or the women had been carried away by an enemy from another. Polygamy was also permitted among the ancient Greeks when necessity seemed to require it, as in the case of the detachment of young men from the army of Laocædæmon, mentioned by Plutarch. It was also allowed among the Etruscans (12 Athen. 8). It was also defended by

Euripides and by Plato, whose doctrine was rather a community of wives than a plurality. The ancient Romans never practised polygamy, though it was not forbidden among them; and Mark Antony is mentioned as the first who took the liberty of having two wives. From that time it became frequent in the Roman Empire till the reigns of Theodosius, Honorius, and Arcadius, who prohibited it A.D. 393. After this Valentinian permitted all his subjects to marry several wives if they pleased; nor does it appear from the ecclesiastical history of the times that the bishops made any opposition to the introduction of polygamy. Pope Gregory II., in a decretal dated 726, allows a man to marry a second wife 'if the first is infirm and incapable of conjugal functions.' We learn from Gregory of Tours that the Merovingian kings had several wives, and that Charlemagne had a great number. Luther looked upon marriage as a civil contract and not a sacrament, and permitted the Landgrave of Hesse to take a second wife during the lifetime of the first.

Polygamy prevailed among the Jewish community both before and under the Mosaic law. But the state of manners had probably become reformed in this respect before the time of Christ, for in the New Testament we meet no trace of its practice. In the Christian code there is no express law upon the subject. The words of Christ, however, in Mat. xix. 9 may be construed by an easy implication to prohibit polygamy, for if 'whoever putteth away his wife and marieth another committeth adultery,' he who marieth another without putting away the first is no less guilty of adultery, because the adultery does not consist in the repudiation of the first wife, but in entering into a second marriage during the legal existence of the first. The passages in St. Paul's writings which speak of marriage always suppose it to signify the union of one man with one woman. But however this may be, polygamy has been as entirely disused and universally prohibited in all Christian countries as if Christianity had expressly forbidden it. Polygamy has been allowed under all the religions which have prevailed in Asia. By the laws of Mohammed every Mussulman is permitted to have a plurality of wives. The Arabs, however, seldom avail themselves of this privilege, and the practice is becoming gradually rarer in Turkey, Egypt, and all those countries that are brought much into communication with western civilization. Although forbidden by the Congress of the United States in 1870, it was practised to a considerable extent among the Mormons up till the year 1890.

In England, originally, the offence of polygamy was considered as of ecclesiastical cognizance only, and although a statute of Edward I. treated it as a capital crime, it appears still to have been of doubtful temporal cognizance until the statute of James I. cap. xi., enacted that persons guilty of polygamy should suffer death, as in cases of felony; but the benefit of clergy was not thereby taken away. By 24 and 25 Vict. cap. c. polygamy is punishable with penal servitude for not more than seven or less than five years, or imprisonment for not more than two. (See BIGAMY.) In the United States the punishment is imprisonment, fine, &c. By a constitution of Charles V. it was a capital crime, and by the laws of ancient and modern Sweden it is punished with death. By the Prussian code of 1794 polygamy is punishable by confinement in a house of correction or fort for at least one and not more than two years.

The practice of polygamy has been defended by several authors in modern times. Montesquieu affirms that it is physically conformable to the climate of Asia. He has also suggested that the irregularity

in the comparative number of each sex born in Asia, which is represented to be greatly superior on the part of the female side, is also an argument in favour of this practice; but there is good reason for denying the reality of this supposed inequality. In the year 1780 the Rev. Mr. Madan published his *Thelyphthora*, in which he attempted to vindicate polygamy, and proposed the introduction of licensed polygamy in case of female seduction as a remedy for prostitution. He was ably answered by a writer in the *Monthly Review*, vol. lxiii. p. 328.

POLYGLOT (Greek, *polus* or *polys*, many, and *glotta*, language), a work which contains the same matter in several languages. It is more particularly used to denote a copy of the Holy Scriptures in which two, three, or more translations are given, with or without the original. Polyglots are of great service for understanding the Scriptures, and were early undertaken by theologians. The first great work of the sort is the Complutensian polyglot, prepared by several learned men, under the patronage of Cardinal Ximenes. Great care and pains were taken in procuring early manuscripts of the text and of the translations. It was splendidly printed (1514-17), in six folio volumes, at Alcalá de Henares, called in Latin *Complutum*, whence the name of the work. It contains the Hebrew text of the Old Testament, with the Vulgate, the Septuagint, a literal Latin translation, a Chaldee paraphrase (which is also accompanied by a Latin translation). Another celebrated polyglot is that of Antwerp, called the *Royal Bible*, because Philip II. of Spain bore part of the cost of publication. It was conducted by the learned Spanish theologian Benedict Arias Montanus, who was assisted by other scholars. It appeared at Antwerp in eight folio volumes (1569-72), and, besides the Hebrew text, contains the Latin Vulgate, the Septuagint (with a literal Latin translation), several Chaldee paraphrases (Targums), also accompanied by a Latin translation, and the New Testament in the original Greek, with the Latin Vulgate, and a Syriac translation in Hebrew and Syriac letters (also with a Latin translation). Still more celebrated is the Paris polyglot, executed principally under the direction of Gui Michel le Jay (an advocate to the parliament, who expended his whole fortune on the object), by several distinguished orientalist and critics. It appeared in 1645, in ten folio volumes, and contains, in addition to the contents of the Antwerp polyglot, a Syriac and an Arabic translation (with Latin), and also the Samaritan Pentateuch (a Samaritan text, with a translation), and likewise an Arabic translation of the New Testament, with a Latin translation of the same. The London or Walton's polyglot, in ten languages, appeared in six volumes folio, with two supplementary volumes (London, 1654-57). It was conducted under the care of Bryan Walton, afterwards Bishop of Chester, and contains all that is in the Paris polyglot, but with many additions and improvements. It contains the original text according to several copies, with an Ethiopic and a Persian translation, and the Latin versions of each. Cromwell patronized the undertaking. Bagster's Polyglot (folio, London, 1831, with later editions) gives eight versions of the Old Testament and nine of the New.

POLYGNOTUS, one of the most distinguished Greek painters, flourished from 450 to 410 B.C. He was a native of the Island of Thasos, and along with his brother Aristophon was instructed in their art by their father Aglaophon. Cimon, the commander, and rival of Pericles, brought him to Athens on the subjugation of Thasos, and employed him to decorate the *Proedria*, or painted portico at Athens. He was the favoured lover of the beautiful Elpinice, sister of Cimon. Micon and Pausanias assisted him

in painting the Pœcils. His two principal pictures there represented incidents of the Trojan war. In the *Lesché* (hall) at Delphi he painted the Conquest of Troy and the Regions of the Dead, which are described by Pausanias. In a portico of the Parthenon there were also several easel-pieces relating to the Trojan war. Polygnotus is represented as being the first who gave life, motion, character, and expression to the countenance, and skilful disposition to the drapery.

POLYGONACEÆ, a natural order of herbaceous, rarely shrubby, plants, with alternate, stipulate or exstipulate leaves, and often unisexual flowers. The perianth is inferior, divided, and not unfrequently coloured; three to nine stamens inserted into the bottom of the perianth; ovary free, usually formed by three carpels, unilocular, and containing one ovule; styles and stigmas equal to the carpels in number. The fruit is generally a nut, often triangular; seed erect; albumen farinaceous. Some species produce a succulent, edible fruit. There are twenty-nine well-known genera, including about 600 species. They are found in all quarters of the globe, but more especially within the north temperate zone. They have astringent and acid properties; some are purgative, and a few are acrid. The fruit of *Fagopyrum esculentum* and other species of buckwheat is used as food. (See BUCKWHEAT.) The leaves of *Rumex acetosa*, or Common Sorrel, and of *R. acetosella*, or Field Sorrel, are acid and astringent. One of the most important plants of this order is the Rhubarb plant. (See RHUBARB.)

POLYGON OF FORCES. See MECHANICS.

POLYHYMNIA, or **POLYMNIA**, according to the later Greek poets the Muse of lyric song and of eloquence, to whom is attributed the invention of the lyre and of mimes and pantomimes. The Grecian artists represented her enveloped in a mantle, crowned with a wreath of flowers, and in a meditating posture. Her attributes are the lyre and the plectrum. She places the forefinger of her right hand on her mouth, or holds a scroll.

POLYMERISM is a particular instance of isomerism (which see).

POLYMORPHISM, the property possessed by certain bodies of crystallizing in two or more forms not derivable one from the other.

POLYNESIA (Gr. *polys*, many, *nēsos*, island), a geographical name applied in its widest sense to the vast island-dotted region extending from south-eastern Asia across the Pacific, and from Behring Strait southward to the Antarctic Ocean, also called Oceania. It has neither physical, ethnographical, nor political unity, and is commonly divided into several sections. Australasia (which see) comprises Australia, Tasmania, and New Zealand, with other islands adjacent. The numerous islands extending from the Malay Peninsula to New Guinea are known collectively as Malaysia or the Malay Archipelago (which see). The Philippine Islands (which see) are often associated with those of Malaysia proper. The name Micronesia (Gr. *mikros*, small, and *nēsos*) is in common use as a collective name for the numerous small islands in the north-western Pacific, between New Guinea and Japan; and Melanesia (Gr. *melas*, black, and *nēsos*) includes New Guinea and a chain of islands extending south-eastwards to the Fiji Islands and New Caledonia, all chiefly inhabited by Papuan races. All the remaining islands, comprised for the most part within the parallels of 30° N. and 30° S. latitude, and between the meridians 180° and 120° W. longitude, constitute Polynesia in the narrower and more definite sense of the term. Practically all the Pacific islands are now in the possession of Britain, France, Germany, and the United

States. Till recently Spain had extensive possessions in Micronesia, and Holland, which owns practically the whole of Malaysia, holds the western half of New Guinea. All the chief groups and islands have special articles devoted to them, but a systematic enumeration may be given here. *Micronesia*: German Possessions—Marshall Islands (acquired in 1885), Caroline Islands (1899), Pelew Islands (Palau-Inseln, 1899), Marianne or Ladrões Islands (except Guam, 1899); British Possessions—Gilbert Islands (1892); United States Possession—Guam (in Ladrões, 1898); Japanese Possessions—Bonin Islands, &c. *Melanesia*: British Possessions—British New Guinea, with the D'Entrecasteaux and Louisiade Archipelagos (1887), British Solomon Islands (all but Bougainville and Buka, 1893–99), Santa Cruz Islands, Banks Islands, Fiji Islands (1874); German Possessions—Kaiser Wilhelm's Land (German New Guinea) and the Bismarck Archipelago (1885–86), Bougainville and Buka (in Solomon Islands, 1886); French Possessions—New Caledonia (1853), with its dependencies Isle of Pines, Loyalty Islands (1864), Huon Islands, Wallis Archipelago (1887), and Futuna and Alafi (1888); Anglo-French—New Hebrides (1887). *Polynesia*: British Possessions—Tonga or Friendly Islands (1900), Savage Island (1900), Union or Tokelau Islands, Ellice or Lagoon Islands (1892), Phoenix Islands, Manahiki Islands (1888), Cook or Hervey Islands (1888; annexed by New Zealand in 1900), Pitcairn Island, Ducie Island, and most of the Central Polynesian Sporades (including Palmyra, Washington, Fanning, Christmas, Jarvis, Malden, Starbuck, &c.); French Possessions—Society Islands or Tahiti (1880–88), Austral or Tubuai Islands (1867), Paumotu, Tuamotu, or Low Archipelago, with the Gambier Islands (1881), Marquesas Islands (1842); United States Possessions—Hawaii or Sandwich Islands (1898), the eastern Samoan Islands (1900), Howland Island, Baker Island, Wake Island; German Possessions—Western Samoan Islands (1900); Chilean Possession—Easter Island.

The islands of Polynesia proper may all be classified under the two great heads, volcanic and coralline. The former are much higher than the latter, and they have usually a more or less mountainous character. The coralline islands are never elevated more than about 600 feet above the sea, and many of them are extremely low. The atoll formation is exceedingly common. On account of the prevaillingly small size of the islands there are not many high mountains or large streams; but the Sandwich Islands have notable volcanoes of great height. Some of the smaller islands are of no value save for their deposits of guano. The indigenous fauna is remarkably deficient in terrestrial mammalia, the only kinds at all generally distributed being bats. The avifauna is large and interesting, and several species of snakes are found in the western islands. The insects and molluscs are of special interest. The coco-palm is grown throughout all Polynesia, and the sago-palm in the west. Bread-fruit, yams, and the taro are staple articles of cultivation. Some of the islands, chiefly in the west, have an extensive and peculiar flora, but others, especially the more easterly, are poor in species. Though Polynesia is almost entirely within the tropics, its climate is generally temperate and very salubrious, owing to the influence of the ocean.

The races of Polynesia all belong either to the Eastern Section of the Ethiopic (Negro) Division of mankind, or to an aberrant group of the Caucasian (White) Division. The negro races of Melanesia are known collectively as Papuasians, and include the Papuans proper of New Guinea and the Melanesians of the other islands. Physically they are character-

ined chiefly by the long head, moderately prognathous jaw, and frizzly hair; the nose in the Papuans is large, straight or arched, with downward tip, in the Melanesians small and broad, with wide nostrils. They are or were cannibals, and are generally of a cruel and treacherous disposition. The Melanesians are more highly endowed mentally than the Papuans. The Samoans, Tahitians, Tongans, Marquesans, Union Islanders or Tokelau, Tuamotu, Hawaiians, and other Polynesians, as well as the Maoris of New Zealand, are now regarded as belonging to the Caucasian section of the human race. For further information on the ethnological relations of the Polynesian races, see the articles on the separate groups or islands, and also the article ETHNOLOGY.

Among the better-known pioneers of exploration in Polynesia are the following: Ferdinand Magellan (1520-21), who discovered the Philippines, Ladrones, &c.; Don Jorge de Meneses, who discovered New Guinea in 1526; Pedro Fernandez de Quiros, discoverer of the Society Islands, the Paumotu Islands, and the New Hebrides in 1606; Abel Janszoon Tasman, who discovered Tasmania, New Zealand, the Fiji and Tonga groups, &c., in 1642-43; William Dampier, who in 1699-1700 explored the coasts of Australia, New Guinea, New Britain, &c.; Philip Carteret, who in 1767 visited the Solomon and Santa Cruz groups, and discovered and named many other islands; Samuel Wallis, who visited the Paumotu and Society groups, and discovered numerous others, in 1767; Louis Antoine de Bougainville, who discovered the Samoan Islands, and visited the Solomon Islands, New Hebrides, &c., in 1768; and James Cook, who during 1771-79 explored the coasts of Australia and New Zealand, visited the Tonga, Fiji, New Hebrides, Society, and other groups, discovered New Caledonia, and rediscovered the Sandwich Islands; other names being those of Lapérouse, D'Entrecasteaux, and Dumont D'Urville. The greater names in Polynesian missionary enterprise are those of John Williams (1796-1839), who was killed by the natives of Erromanga, in the New Hebrides; George Augustus Selwyn (1809-78), first Bishop of New Zealand and Melanesia; John Coleridge Patteson (1827-71), Bishop of Melanesia, killed by the Santa Cruz natives; John Gibson Paton (born 1824), well-known for his work in the New Hebrides; and James Chalmers, killed in New Guinea in 1901.

POLYNICES. See EREOCLAS and THEBES.

POLYPE, POLYPI, &c. The term 'Polype' has been very variously and indiscriminately applied to different animal forms. It has thus been used to designate any animal of low organization, such as the sea-anemones, corals, and their allies; or it has been employed to indicate animals, which, like the Coelenterate Zoophytes or Hydrozoa, and the Molluscan Polyzoa, bear a close resemblance to plants. Whilst it has been also popularly applied to such forms as the Cuttle-fishes, though in this latter case the nearly-related term 'poulpe' has supplanted the use of the more general polype. The most obvious disadvantage of the term when used in zoology, and as frequently employed in the older works, is that it has been used to include in one group animals of a widely dissimilar nature, and which frequently possess no true or structural relationship whatever. The applications of the term 'Polype' and allied names have, however, been greatly altered and improved for the better in the modern terminology of natural history. At present the term *Polype* is limited to denote any single member of the class Actinozoa, represented by the Sea Anemones, Corals, and the like; or any member (or zooid) of a compound organism belonging to that class. The term *Polypide* is now employed to designate each member or

solid of the compound forms included in the peculiar class Polyzoa or Bryozoa, represented by the Sea-mats (*Fustra*), &c. The name *polypidum* applies to the entire outer framework or skin-system of a compound form, such as a Hydrozoan Zoophyte or an individual Polyzoon. The word *polypids* refers to each separate zooid or member of a compound Zoophyte or Hydrozoön, and is thus used in opposition to the term *polypide* already explained. The *polypary* of a Hydrozoön specially refers to the horny or chitinous skin secreted by the Hydrozoa. See also COELENTERATA, HYDROZOA, MOLLUSCA, POLYPSA, &c.

POLYPHEMUS, son of Poseidon, the most famous of the Sicilian Cyclopes, is described as a giant living by himself in a cave in Mount Ætna and feeding his flocks on that mountain. Ulysses and his companions having been driven upon the shore by a storm, and having unwarily taken refuge in his cave, were found there by Polyphemus when he returned home at night and shut up the mouth of the cavern with a large stone. Having seized two of the strangers he ate them for supper, and the next morning made a breakfast of two more of them, after which he drove out his flocks to pasture, and shut up the unhappy captives by closing the entrance of his cave. Ulysses then contrived a plan for their escape. He intoxicated the monster with wine, and as soon as he fell asleep bored out his one eye with the blazing end of a stake. He then tied himself and his companions under the bellies of the sheep, in which manner they passed safely out in the morning. Polyphemus was the lover of the nymph Galatea, but the nymph despised his offers, and preferred Acis, who was killed by his jealous rival. See GALATEA.

POLYPHONIC, a term applied to a musical composition in two or more parts, each of which forms an independent theme, progressing simultaneously according to the laws of counterpoint, as in a fugue, which is the best example of polyphonic compositions. (See COUNTERPOINT—Example IV.) Compositions consisting of a leading melody, with subsidiary parts added to strengthen it, are called homophonic.

POLYPTERUS, a genus of fishes inhabiting the Nile, Senegal, and other rivers of Africa, and included in the Ganoid order of the class. They form types of a special family, the Polypteridae, and belong to the group of Ganoid fishes known as the Crossopterygidae—that is, those in which the pectoral, and generally the ventral fins also, consist of a central piece or disc formed by the skeleton of the limb, and covered with scales. To this disc the fin-rays are attached. The scales are ganoid, and are of solid enamelled texture, and of rhomboidal shape. They overlap each other; and are, in addition, articulated by means of processes which spring from the one set of scales and fit into depressions in neighbouring scales. The body is cylindrical, and of elongated form. The head is somewhat flattened. A pair of openings termed *spiracles* exist on the top of the head, through which water may be conveyed to the gills. The spiracles may be closed at will by valvular structures. The pectoral fins are of rounded shape. The ventral fins are situated far back on the body. A single anal fin exists; but the dorsal fin is remarkable as being broken up or divided into numerous detached portions, each consisting of a front spine with a soft fin attached to its hinder margin. No 'fulcræ' or pointed bony plates exist on the margins of the fins in Polypterus. The caudal or tail fin is heterocercal, but is not markedly asymmetrical in the disposition of its lobes. The bodies of the vertebrae are fully ossified, and are amphicoelous in form—that is, concave both in front and behind. No branchiostegal rays exist in these fishes. The

air-bladder is of double conformation, and sacculated or cellular, whilst it communicates with the gullet by a tube—the 'pneumatic duct'. This disposition of parts renders the air-bladder somewhat lung-like in appearance and homology. The united ureters open into the cavity of the united oviducts in *Polypterus*, instead of the oviducts opening into the ureters as in other Ganoid fishes. The *Polypteri*, from the complete investment of their bodies in ganoid scales, are included in the *Lepidoganoidei* group of their order. The familiar Nile species (*P. bichir*, figured at ICHTHYOLOGY) possesses sixteen divisions in the multifold dorsal fin. *P. Senegalensis* of the Senegal River has twelve similar divisions. The former attains an average length of about 18 inches. It appears to inhabit the muddy bottom of the river. Its flesh is esteemed good for the table. The *Polypteri* are unknown as fossil organisms.

It may lastly be remarked that the young of *Polypteri* have recently been stated to possess outside or external gills in the young state, and to lose these on attaining the adult state. In the curious *Lepidosirens* or Mud-fishes (see DIPNOI) external branchiæ are known to be occasionally developed; and if these organs be present in *Polypteri*, the fact will show them to be allied to the *Lepidosirens*, and through these latter to the amphibian Vertebrata (Frogs, Newts, &c.), all of which possess external gills in early life.

POLYPUS, in medicine, a name given to swellings or growths which form chiefly in connection with the mucous membranes, and thus may exist in many situations. These tumours are most common in the nostrils, the throat, the uterus, and are more rarely found in the stomach, the intestines, the bladder, or the external passage of the ear. *Polypuses* differ much in size, number, mode of adhesion, and nature. One species is called *soft* or *vesicular* polypus, because its substance is soft, spongy, vesicular, the interstices being filled with semi-fluid material; another is called the *hard* polypus, and has been distinguished into the fibrous or fleshy and the scirrhous or cancerous. The fibrous polypuses are of a dense, close texture, and of a whitish colour; they contain few vessels, and do not degenerate into cancers. The scirrhous or *cardinomatous* polypuses are really cancerous, painful tumours which discharge blood and exhibit all the pathological changes of cancerous affections. Different modes of treatment must be adopted, according to the particular nature of the disease. Among the methods of cure are *excision*, which consists in subjecting the polypus to the action of astringent powders or solutions to effect the resolution of the tumour; *cauterization*, or the application of fire and caustics; *excision*, or the removal of the polypus by the knife; *extraction*, or its removal by the fingers or by pincers; the *seton*, which consists in the application of a wire or thread for the purpose of destroying the pedicle; by *ligature*, which consists in tying up the base of the tumour, and causing it to fall off by the destruction of the vascular pedicle which nourishes it; or by the *écraseur*, which is now most frequently adopted.

POLYSYNDETON (the opposite of *asyndeton*) is the name given to a figure of speech by which the conjunctive particles of sentences are accumulated, contrary to usual custom, either for the purpose of giving a greater emphasis to the terms connected by them, as when Schiller says, 'And it waves and boils, and roars and hisses:' or more distinctly to mark the gradual transition from one circumstance or subject to another; or to retard the too rapid progress of objects presented; or to render the connection between different sentences, or different parts of the same sentence, more visible and distinct.

POLYTECHNIC SCHOOL. See **SCHOOLS POLYTECHNIQUE**.

POLYTHEISM (Greek, *polus* or *polys*, many, and *theos*, god), the belief in, and worship of a plurality of gods; opposed to monotheism, the belief in, and worship of one God. It is still a matter of debate whether polytheism is a primary form of human belief, or a degeneration of an original monotheistic idea. It is argued, on the one hand, that the sense of personal dependence into which most philosophers have agreed in resolving the earliest elements of natural religious feeling, could not, in the first instance, lead man to a notion of a plurality of gods. The undefined power which he feels to be around and above him, the mysterious something which is independent of him and which is stronger than he, did not primarily present itself to his mind except under a form of unity. His earliest religion would therefore be of a monotheistic character, but of a highly unstable nature, and eminently liable, amongst races of rude faculties and little power of abstraction, to assume a polytheistic form. It was far from attaining the level of a dogmatic monotheism, a religion which not only possesses the conception of God as one, but a conception the negation of the existence of more gods than one—a negation which is only possible after the conception of more gods than one. The lapse from the monotheistic idea may be explained in two ways, according as we may suppose it to have arisen from infirmity of thought or deficiency of language. According to the former theory the lapse would be the result of the dominion exercised at all times, but most of all in a rude age, of the senses over the reflective faculty. The idea of one Supreme Being would be always liable to be obscured by the multiplicity of the visible operations of that being on earth. The tiller of the soil, in simple times, waiting anxiously for the sun or rain, would, on his joy at their arrival or despair at their approach, be prone to attribute his good or ill fortune to some individual power for whose benefits he must be grateful, or whose wrath he must propitiate; and a worship containing the elements of prayer and thanksgiving would soon spring up between man and those supposed powers who governed the earthly phenomena. It is held by those who ascribe the corruption of the monotheistic idea to a deficiency of language that the inability of mankind either to ascend to the conception of an abstract being, or, in a rude age, to adapt language to such a conception, prevented man from giving the Unseen Being a name connoting that existence which they were conscious of as one; and they were therefore compelled to designate him by names connoting those acts and attributes which they were conscious of as many.

We come now to give a brief statement of the arguments of those who affirm that polytheism was a primary form of religious belief. Ignorant of the nature of his own life, and of the nature, origin, and properties of other objects, man at first could only attribute vaguely to all visible things the same kind of existence as that which belonged to himself. This existence involved simply the notion of consciousness, for the distinction between consciousness and personality was of later growth. Thus the sun, moon, and stars would all be living beings; and their influence, from the absence of any idea of a natural order, would be seen in the working of the material world, and in all the accidents of human life. Their actions would appear beneficent or malign; and hence these beings would be invested each with a special character. As being beyond human control, and as affecting the condition of men, they would be loved or feared; and with the growth of the idea that they might be propitiated or appeased the system of poly-

thalam would be complete. See MONOTHEMISM and MYTHOLOGY.

POLYZOA (Greek, *polus*, many; *zōn*, animal), a class of Molluscoida or Lower Mollusca (see MOLLUSCA), sometimes also known by the name of Bryozoa (Greek, *brūon*, moss, and *zōn*). The former name has been applied to this group in allusion to the invariably compound nature of its included forms, whilst the latter name was given from the plant or moss-like appearance presented by many members of the class. The class Polyzoa may be defined as comprising Molluscoida, which always form compound colonies. The body consists of an alimentary tract, contained within a sac or cell, with double walls. The upper part of the alimentary tract may be protruded from or withdrawn into the sac, that is, may be evaginated or invaginated. The mouth is surrounded by a circle of hollow tentacles provided with cilia. No heart exists in this class. The Flustræ or Sea-mats, so frequently cast up on our shores, and which resemble pieces of pale brown sea-weed, exemplify familiar members of the group. When the sea-mat organism is examined the seaweed-like structure is seen to be composed of numerous little closely-set cells, in each of which a little animal was contained. The entire structure is known as a *polyzoarium*, and the individual *zoidæ*, or forms, which by their aggregation make up the colony, are known as *polypides*. The compound mass is produced from a single primitive polypide by a process of gemmation or continuous budding. Each cell and its tenant is the counterpart of its neighbours. There is an outer coriaceous or calcareous cell-wall, the *ectocyst*, and an inner, soft, contractile wall, the *endocyst*. The ectocyst forms the connecting medium by means of which the different cells are bound together. On the ectocyst certain peculiar processes named *avicularia* (or 'bird's head processes') and *vibracula* are found. These structures exhibit independent movements, and their functions are wholly undetermined. The mouth opening at the upper part of each cell is surrounded by a circlet of hollow ciliated tentacles, on which devolves the function of respiration. A gullet, stomach, and intestine are suspended within the cell, amid the clear fluid (*perigastric fluid*) which fills the interior. This fluid undergoes a circulation in each cell through the movements of the vibratile cilia or delicate hair-like filaments which line the endocyst. The anal opening is situated in close proximity to the mouth, and between the mouth and anus the single nervous ganglion is situated. A 'colonial nervous system' (Müller) is supposed also to exist, by means of which the various members of the colony are brought into relation with each other. The tentacles are borne upon a stage or *lophophore*, which in the majority of marine Polyzoa is circular in shape, but in most of the fresh-water forms is horse-shoe shaped or crescentic in form (*Hippocrepian Polyzoa*). In the Hippocrepian forms a valvular lid termed the *epistome* exists, this structure overhanging the aperture of the mouth. The tentacles and upper part of the digestive tract can be invaginated, that is, may be withdrawn into the cell after the fashion of a glove finger thrust in upon itself. The muscular system of these forms is highly developed; the muscles (retractors) which retract the animal within the cell being especially developed. The evagination or protrusion of the tentacles appears to be effected by circular fibres which are disposed around the cell, and particularly around the oral opening. A gizzard is described as being present in some Polyzoa; and the functions of a liver have been ascribed to certain cells in the neighbourhood of the stomach. The reproductive organs consist of ovary and testes; male and female elements being thus contained within each cell

of the colony. These give origin to fertilized ova or eggs, which escape from the cells, and develop each a single primitive polypide or cell; and this latter by a process of budding produces the compound colony of the Polyzōon. Each colony has thus of itself an unlimited power of increase by budding, and also the power of giving origin to new colonies through eggs produced by a truly sexual process. The *winter-ova* or *statoblasts* of Polyzoa are peculiar bodies consisting of germinal matter inclosed between two horny discs like watch-glasses placed face to face, and united by a ring running round the edge of the discs. These statoblasts are produced by a process of budding on a cord-like structure which is attached to the stomach, and which is termed the *funiculus*. They are liberated from the parent body generally after its disintegration. When thus set free the discs of the statoblast separate, and a primitive polypide escapes, which soon attaches itself and develops all the features of the individual from which it sprung. These bodies are regarded by Allman as being peculiar buds or *gemmæ*, which are destined to survive the cold of winter, and which thus lie in a dormant or quiescent state prior to undergoing development. No sexual process is concerned in the production of statoblasts, and therefore they are not to be regarded as in any way corresponding to true ova.

The class Polyzoa is divided into two orders. The *Phylactolemata* possess a crescentic lophophore and an epistome. The *Gymnolemata* or Infundibulata possess a circular lophophore and want the epistome. The *Gymnolemata* are represented by marine Polyzoa exclusively, with the exception of a single family, that of the Paludicellæ, represented by the *Paludicella articulata* (a species occurring in certain Irish loughs), and by *Urnatella*. The other chief divisions of this group are, firstly, the *Cylostomata*, represented by the genera *Tubulipora*, *Diastopora*, *Crisia*, &c., in all of which the cells are tubular, and the cell-opening terminal in position and of the same diameter as the cell; whilst the outer portion of the cells is generally calcareous. The *Oheilostomata* possess less completely retractile polypides, the orifices of the cells being sub-terminal, the cells not tubular, and of fleshy, horny, or limy consistence. The genera *Salicornaria*, *Cellularia*, *Scrupocellaria*, *Scruparia*, *Gemellaria*, *Bicellaria*, *Flustra*, *Carbacea*, *Membranipora*, *Leprælia*, *Celsipora*, *Eschara*, &c., are included in this latter division. The *Ctenostomata*, in which the orifices of the cells are terminal and provided with fringe-like structures for their closure, form the last group of the *Gymnolemata*. The cells in this division are distinct, and originate from a common tube. The genera *Alcyonidium*, *Sarcocidium*, *Vesicularia*, *Valkeria*, *Bowerbankia*, &c., represent the *Ctenostomata*.

The *Phylactolematous* Polyzoa include the fresh-water sub-order Lophopæa, the marine Rhabdopleures, and the marine Pedicellinæ. The genus *Lophophus* represents the first sub-order; and other prominent fresh-water genera are *Cristatella* and *Plumatella*.

POMACEÆ, a natural order of plants, according to some botanists, but generally considered as a division of the natural order Rosaceæ. It differs from Rosaceæ proper in having the tube of the calyx more or less globose, the ovary fleshy and juicy, lined with a thin disc, in the adhesion of the carpels with the sides of the calyx, and more or less with each other. The fruit is always a *pome*, that is, it is made up of a fleshy calyx adhering to fleshy or bony ovaries containing a definite number of seeds. The plants belonging to this order or sub-order are peculiarly distinguished by their ovules being in pairs and collateral; while rosaceous plants, when they have two or more ascending ovules, always have them placed

one above the other. There are about 200 species found plentifully in the temperate and colder regions of the northern hemisphere; they may be said to be entirely absent from the southern hemisphere. The order, which consists exclusively of trees and shrubs, produces a number of the finest fruits of temperate climates, as the apple, pear, quince, medlar, &c.

POMADE, **POMMADE**, or **POMATUM** (Latin, *pomum*, apple), a term originally applied to a fragrant ointment prepared with lard and apples, but now wholly restricted to perfumed solid greasy substances used in dressing the hair. In the preparation of pomades the first object of consideration is to obtain their fatty basis in as pure and fresh a state as possible. Lard, beef and mutton suet, beef marrow, veal fat, and bear's grease are the materials commonly employed for this purpose, either singly or in mixtures of two or more of them. The fat, which should be that of a young and healthy animal, is pounded in a marble mortar in the cold, until all the membranes are completely torn asunder; it is then submitted to the heat of a steam-bath until its fatty portion has liquefied, and the albuminous and aqueous matter and other foreign substances have completely subsided. The liquid fat is then carefully skimmed and passed through a flannel filter. In this state it may be perfumed at will; after which, when it is intended that the pomade should be white, it must be constantly stirred with a glass or wooden spatula until it solidifies; should it be wished transparent or crystalline it is allowed to cool very slowly without being disturbed. To prevent its becoming rancid a little benzoic acid, gum benzoin, or nitric ether may be added, and to increase its consistency a little wax or spermaceti. Pomade may be perfumed by enflourage, maceration, or simply by adding the fragrant essences or essential oils in the required quantity. See **PERFUMERY**.

POMBAL, **SEBASTIÃO JOSÉ CARVALHO**, Count of Oeyras, Marquis of, a celebrated Portuguese statesman, was born in 1699 at the castle of Soura, near Coimbra, and died in 1782. His father was a captain of artillery, and belonged to the lower class of the nobility; and the son, after having studied law at Coimbra, served also for some time in the army. Nature had given him all the qualities which indicate a person destined for rule; a tall and strong frame, a vigorous constitution, strong passions, a penetrating judgment, and the most captivating address. Having been banished from Lisbon on account of some youthful imprudences, he passed several years at Soura devoted to study. While there he married Teresa de Noronha Almada, a rich widow, and subsequently returned to court, where his address acquired him such high favour that in 1739 he was appointed ambassador to London. The new minister, Peter di Motta, his enemy, recalled him in 1745; but the queen, who was his patroness, sent him to Vienna to act as mediator between the pope and the Empress Maria Theresa. Carvalho here gained general esteem, and his first wife being dead obtained the hand of the youthful Countess of Daun. The queen now procured his nomination as ambassador to the Spanish court; but the king and his minister hated him; he was recalled, and even the influence of the queen was insufficient to overcome the aversion of the king (John V.) This monarch died in 1750, and through the influence of the queen-dowager Carvalho obtained from his successor Joseph I. the post of secretary of state for foreign affairs. He soon rendered the feeble and sensual king (particularly after the death of the queen-mother, 1754) entirely subject to his influence. Joseph I. fell in with the most daring projects of his minister; and the latter now proceeded to the accom-

plishment of his four favourite objects—the expulsion of the Jesuits, the humiliation of the greater nobles, the restoration of the prosperity of Portugal, and the absolute command of the state in the name of the monarch. England, the Jesuits, and the nobility monopolized the wealth of the country, which was without an army or a fleet, without commerce or agriculture. It required a man of his character to withstand the attacks to which he was exposed from the Inquisition, whose *autos da fé* he prohibited; from the Jesuits, whom he expelled from their missions in Paraguay; from the leading nobles, whom he deprived of their princely possessions in the colonies; and from the prelacy, whose powers he abridged. Then came the earthquake of November 1, 1755, which destroyed Lisbon. Carvalho appeared in the midst of the general despair as a saviour, displaying a vigour and resolution which alone ought to have conciliated his enemies. The king submitted implicitly to his direction. Carvalho was now created Count of Oeyras, and in 1756 first minister. He then removed every one who ventured to obstruct his plans. But with the pride of the great, whom he humbled, and the avarice which his commercial regulations exasperated, was now connected the discontent of the country people, excited by his establishment of monopolies. The discontented vine-dressers committed excesses in Oporto, but Pombal vigorously suppressed the riots, and passed the most comprehensive laws against treason, which made the will of the king valid against all constitutions and privileges. He also exposed, to the astonishment of Europe, the conduct of the Jesuits in their government in Paraguay. In his *exposé* of this matter there are certainly many exaggerations, and there is no doubt that the fathers ruled these provinces much better than the government of Spain or Portugal would have done. Carvalho finally determined to remove the Jesuits entirely from the person of the king. They were deprived of the place of confessors, and were ordered (September 16, 1757) to retire to their colleges. Several Portuguese grandees who had joined in intrigues against the minister were banished from Lisbon. A conspiracy against the life of the king, who was wounded on the night of September 3, 1758, by assassins, delivered the minister's mortal enemies into his hands. Three months after the attempt Pombal arrested the Marquis of Tavora and his family, the Jesuit Malagrida, and the next day the Duke of Aveiro and others. The minister and a member of the supreme judicial tribunal conducted the examination, and after a hasty trial the Duke of Aveira and the Marquis of Tavora were broken on the wheel; the sons and the son-in-law, with the servants of the former, were strangled; the wife of the marquis was beheaded, and a servant of the duke burned. The minister denounced the Jesuits to the pope as the contrivers of the scheme, and not being able to procure immediately a bull permitting the secular tribunals to proceed against them, he caused some of them to be executed in prison. Malagrida, who had prophesied the death of the king, was condemned to the flames by the Inquisition, and burned in 1761. Pombal had already banished the whole order from the kingdom by a royal decree of September 3, 1759, and as they did not comply with the mandate caused them to be seized by the soldiers and transported to the States of the Church. These proceedings gave rise to a protracted dispute with the pope; in 1760 Pombal transported the Papal nuncio beyond the frontiers, and was on the point of dissolving all connection with Rome when Clement XIII. died, and Clement XIV. his successor, abolished the order in 1773. Portugal was soon after

involved in a short war with Spain, and at a subsequent period in a second war, on account of the minister's haughty conduct towards that government. The Portuguese army received an entirely new organization, and the fortifications on the frontiers were put in a better condition. Pombal was no less active in his efforts to improve the country in every relation, and paid particular attention to the schools; he also rendered the censorship less strict. Joseph I. died February 24, 1777, and was succeeded by his daughter Maria I., the bitter enemy of Pombal, whom she at once deprived of his offices. The state-prisoners whom he had incarcerated, 9800 in number, were released, and all his regulations were abolished. Pombal transferred to the young queen a treasure of 78,000,000 cruzados, and a well-organized state. The nobility left no means untried to bring him to the scaffold. The queen caused an examination to be made into the trial of the assassins of the king, and Pombal saved himself only by exhibiting the original proofs of the conspiracy, which had not been made public. He retained his titles and his estates, and, retiring into the village of Pombal, died there 8th May, 1782.

POMEGRANATE (*Punica Granatum*, natural order Myrtacæ). In its wild state this is a dense spiny shrub, 8 or 10 feet high, but when cultivated with care, and in a favourable climate, it attains double these dimensions. It is supposed to have originated in the north of Africa, and thence to have been introduced into Italy. By the Romans it was called *malum Punicum*, or Carthaginian apple, and the country adjacent to Carthage was then celebrated for its production. It is the *rimmon* of Scripture. The leaves are opposite, lanceolate, entire and smooth; the flowers are of a brilliant red, large, and almost sessile; the fruit, when cultivated, attains the size of a large apple, and has a thick coriaceous rind, crowned at the summit with the teeth of the persistent calyx. It is filled with a multitude of small red seeds, and the pulp is more or less acid, and slightly astringent. The pomegranate is now naturalized as well as extensively cultivated throughout a great part of the south of Europe, for the sake of the fruit; and even in those climates where, like our own, this does not attain perfection, the beauty of the flowers renders it a favourite ornamental shrub. Numerous varieties have been produced, differing in the beauty of their flowers and in the taste and quality of the fruit. The pomegranate, in warm climates, sometimes attains a great size. A cooling and agreeable beverage is made of the juice mixed with water and sugar or honey. Another species (*P. nana*) inhabits the West Indies and Guiana, where it is sometimes used as a hedge plant. The flowers and fruit are very small.

POMERANIA (German, *Pommern*), a province and duchy in the northern part of Prussia, bounded north by the Baltic, west by the Duchy of Mecklenburg, south by the province of Brandenburg, and east by West Prussia; area, 12,000 square miles. It consists of a long and comparatively narrow tract of country, stretching longitudinally east to west. The coast is generally low and sandy, and is lined by a great number of lagoons, separated from the sea by narrow belts of land or low sandhills. The chief of these lagoons are the Binnensee, the Lebasee, and the Stettiner-haff or Pommersche-haff. The last forms the embouchure of the Oder, and communicates with the Baltic by three channels—the Peene, Swine, and Divenow. Owing to the general lowness of the coast, where it is not protected from the waves by the downs or low hills already mentioned, artificial embankments, like those of Holland, become necessary. Along the coast are a few islands,

but none of them, except Rügen, Usedom, and Wollin, are of great extent. The interior is almost a continuous flat, including considerable marshy tracts, with a very gradual inclination towards the Baltic, by which all its drainage is received. The principal rivers are the Oder, Persante, and Stolpe. The soil on the whole is sandy and indifferent; still there are many rich alluvial tracts, particularly along the banks of the rivers and lakes, producing a surplus of grain for export. Much of what is thus exported is of the finest quality, and the Pomeranian wheat is well known in the English market, where it often commands the highest price. Flax, hemp, and tobacco are also cultivated. The domestic animals are numerous, and of tolerably good breeds: those which appear to attract most attention are sheep and swine. The forests are of large extent, and well supplied with game. Fish also are abundant. The only minerals of any consequence are a little iron, salt, and alum. Manufactures early made considerable progress, in consequence of the influx of French refugees on the revocation of the edict of Nantes, who introduced the manufacture of woollens and other fabrics. The possession of the Oder enables the province to carry on a considerable trade, both general and transit. The principal exports are corn, cattle, wood, wool, wax, amber, and fish; the principal imports are wine, cotton goods, coffee, sugar, and other articles of colonial produce. The centre of trade is Stettin, which ranks as one of the most important commercial cities of Prussia. Pomerania appears to have been originally inhabited by Goths, Vandals, and Slaves. The first mention of it in history is in 1140. It long remained an independent duchy, and was of much larger extent than at present. In 1637, on the extinction of the ducal family, the electoral house of Brandenburg claimed possession, but was obliged to give way to Sweden. On the death of Charles XII. the electoral house again claimed possession, and the whole was formally ceded to it except a part which received the name of Swedish Pomerania. This part having been ceded to Denmark, was by it given up in exchange for the Duchy of Lauenburg, to Prussia, to which the whole of Pomerania now belongs. For administrative purposes it is divided into three governments (*Regierungs-bezirke*), Stettin, Köslin, and Stralsund. Pop. (1880), 1,540,034; (1895), 1,574,147.

POMONA, among the Romans the goddess of fruit, and wife of Vertumnus, who succeeded, after all the rustic gods had long vainly tried to secure her love, in obtaining both her heart and her hand. Her worship was confined to the Romans. At Rome she had her own priest (*flamen Pomonalis*), and was usually represented with a basket of fruit, or with fruit in her bosom. Often also she appeared with a garland of fruit encircling her head.

POMONA, or **MAINLAND**, the largest and most populous of the Orkney Islands, open to the Atlantic on the west and east, but separated by channels from Rowa, Shapinsha, &c., on the north, and from Hoy, South Ronaldsha, &c., on the south. Length from north-west to south-east, 23 miles; extreme breadth about 15 miles, but at the town of Kirkwall only about 2½ miles; area, 150 square miles; pop. 17,166. It is extremely irregular in shape, and on all sides except the west is deeply indented by bays and creeks, among which are Kirkwall Bay, Scapa Flow, Stromness Bay, Deer Sound, Holm Sound, and another on the south-west, entering from Hoy Mouth, and communicating by a narrow strait with a large and beautiful expanse called the Loch of Stennis. The coast is bold and elevated on the north-west and west, where the ocean often breaks with tremendous fury; here and in other parts the action of the water

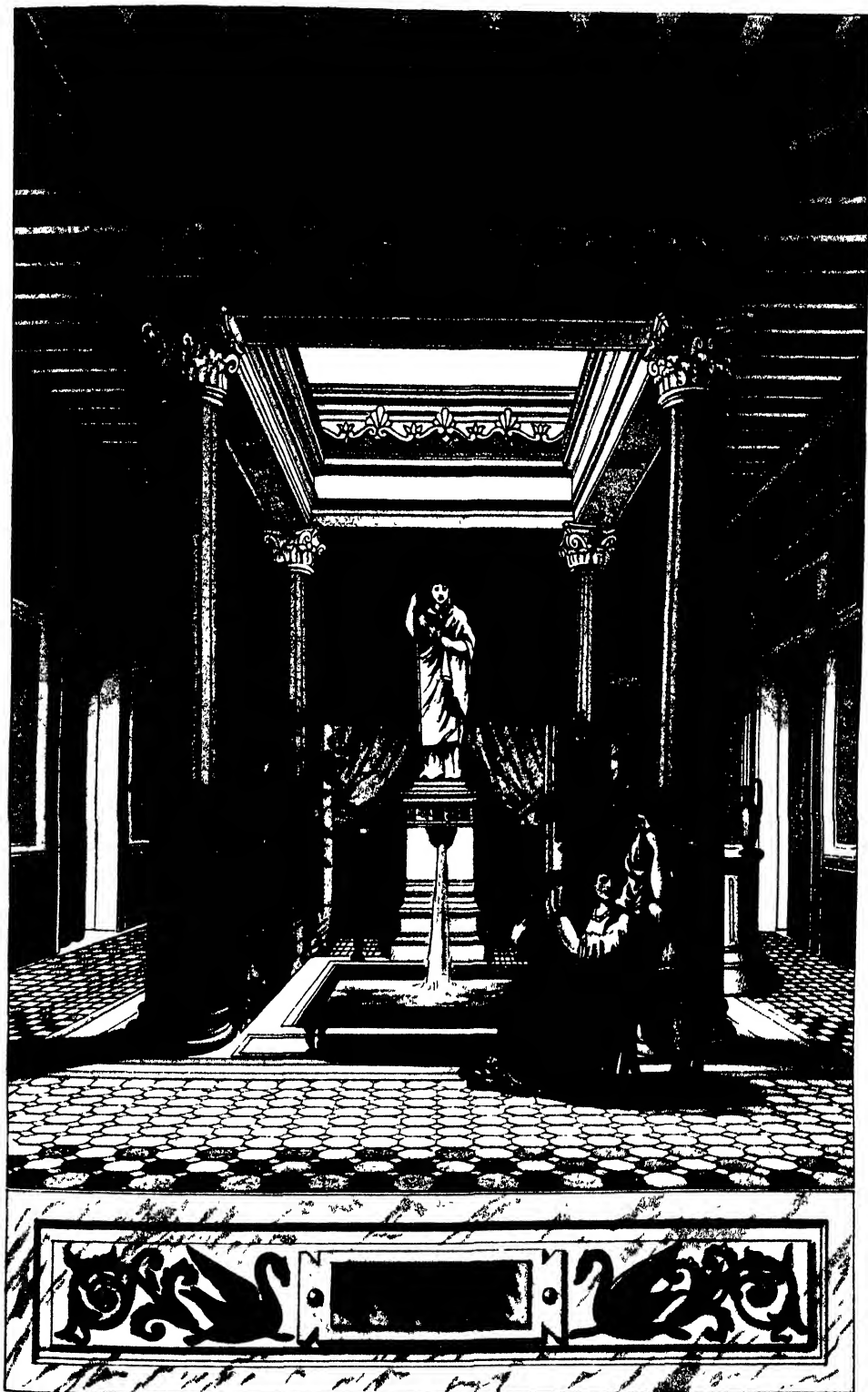
has produced several remarkable caverns. The general slope is eastward, and in that direction the beach often becomes low and sandy. The interior is diversified with hills, valleys, and lakes (the Loch of Stennis being the largest), but wants the beauty which woods would give it, trees existing only in some few sheltered spots. The surface is covered in great part by moor and heath, but good pasture is also to be found, and in the valleys a good loamy soil occurs. The principal towns are Kirkwall and Stromness. See *ORKNEY*.

POMPADOUR, JEANNE ANTOINETTE POISSON, MARQUISE DE, the mistress of Louis XV., in whose affections she succeeded Madame de Chateauroux. She was born on the 29th of December, 1721, and was the daughter of François Poisson, whom Jal proves to have been equerry to the Duke of Orleans, and not butcher to the Invalides, as frequently stated. The paternity of the future favourite was, however, claimed by Lenormand de Tournhem, a rich fermier général, who spared no pains to give the lovely child a brilliant fashionable education, and who at his death left her the half of his immense fortune. In 1741 she was married to her cousin Lenormand d'Etiolles, an ugly little man, who loved the beauty passionately, but in whom she only saw the means of obtaining a fixed position in society. Her ambition was fired by the infamous counsels of her mother, and the prophecy of a fortune-teller, that she would one day become the favourite of the king. The chateau d'Etiolles was surrounded by a forest in which Louis XV. often led the chase, and Madame d'Etiolles seized every opportunity of throwing herself in his way. She at last succeeded in attracting his attention, was formally presented to him, and soon entirely engrossed his favour. In 1745 she appeared at court under the title of Marquise de Pompadour. Here she enjoyed the highest consideration, but did not at first interfere in political affairs, satisfied with appearing as the patroness of learning and the arts. She collected books, pictures, and curiosities, and encouraged the institution of the military school of which Paris du Verney was the founder. But when her charms began to fade, and she could only maintain her influence with the king by furnishing him other objects for the gratification of his passions, she turned her attention to state affairs. She filled the most important offices with her favourites, and contributed to produce those evils which afterwards pressed so heavily on France. It is said to have been principally owing to her that France became involved in the war against Frederick II. The Empress Maria Theresa had propitiated her favour by writing to her with her own hand, in which she called her 'dear cousin.' The burdens and sufferings which this war brought upon France must be laid at her door, since she removed Bernis, who was in favour of peace, and supplied his place by Choiseul, effected the recall of Marshal d'Estrees at the moment of triumph, and promoted incapable generals to the command. She died in 1764, at the age of forty-four years, little regretted by the king (see *LOUIS XV.*), and hated and reviled by the nation. The memoirs and letters which appeared under her name are not genuine, but are attributed to the younger Crébillon. See the *Mémoires* of Mad. Campan, and those of Du Hausset.

POMPEII, an ancient city of Campania, situated on the Bay of Naples, about 12 miles south-east from the city of that name, at the mouth of the river Sarno (the ancient Sarnus), and immediately at the foot of Mount Vesuvius. All accounts agree in representing it as a very ancient city, and a tradition ascribed its foundation to Hercules. According to Strabo it was first occupied by the Oscans, subse-

quently by the Tyrrhenians and Pelasgians, and afterwards by the Samnites, in whose hands it continued till it came into the possession of the Romans. It probably became from an early period a flourishing commercial town, owing to its advantageous position at the mouth of the river, which was formerly navigable for a short distance above the city, and which rendered it the port of Nola, Nuceria, and all the rich plain watered by the Sarnus. But no mention of its name is met with in history until 310 B.C., when a Roman fleet touched there, and landed troops, who ravaged the territory of Nuceria. We find no subsequent notice of it till the outbreak of the Social war (91 B.C.) The rebels were defeated in the vicinity by Sulla, who afterwards laid siege to the town itself. Whether it fell into his hands by force or capitulation we cannot now tell, probably the latter, as it escaped the fate of Stabiae, and its inhabitants were admitted to the Roman franchise, though they had to relinquish a third of their arable land to a colony of soldiers sent thither 82 B.C. Before the close of the republic Pompeii became a favourite retreat of Romans of the wealthier classes, who purchased estates in the vicinity, Cicero among others having a villa there. Under the early emperors it continued to be resorted to for the same purpose. Seneca praises its pleasant situation, and Tacitus calls it a populous and flourishing town. The last-mentioned writer records a serious conflict which took place in the amphitheatre between the Pompeians and the newly-settled colonists of Nuceria (59 A.D.), in consequence of which the former were prohibited from having theatrical and gladiatorial exhibitions for a period of ten years. Four years later (63 A.D.) a fearful earthquake occurred, which destroyed most of the public edifices and many of the private houses of the town. The citizens abandoned it for some time, and the Roman senate even contemplated prohibiting its reconstruction. At the end of a few months the work of rebuilding was commenced and carried rapidly forward. The new town was not quite completed, however, when it was overtaken by the catastrophe of 24th August, 79. The first premonitory symptom was a dense shower of ashes thrown from the flaming crater of Vesuvius, which covered the town with a stratum about 3 feet in depth, and which allowed the greater number of the inhabitants to escape. Many of them returned, some doubtless to rescue their valuables; others, paralyzed with fear, and not knowing whither to turn their steps. The number of skeletons of those who thus perished in one-third part of the town already excavated is variously stated from 400 to 600. The ashes were followed by a stupendous shower of red-hot *rapilli* (fragments of pumice-stone of all sizes), which covered the town to a depth of 7 to 8 feet, and was succeeded by fresh showers of ashes, and again by rapilli. No lava current seems to have ever reached the town. The present superincumbent mass is about 20 feet in thickness. A portion of this was formed by subsequent eruptions, but the town had been buried by the first catastrophe and entirely lost to view. A small straggling village, which sprang up on or near the spot, long served to maintain the name, but after the eruption of 472 the site was finally abandoned, and during the middle ages Pompeii was consigned to oblivion. In 1592 the great engineer and architect Domenico Fontana constructed a subterranean water-conduit for conveying the water of the Sarno to Torre dell' Annunziata, actually intersecting the ruins, yet no further excavations were made. It was not until 1748, when a peasant in sinking a well discovered a painted chamber with statues and other objects of antiquity, that anything like a real interest in the locality was

POMPEII.



excited. Charles III., in whom the discovery of Herculaneum had awakened a desire for further explorations, ordered the excavations to be prosecuted. In 1755 the amphitheatre, theatre, and other parts were cleared out. Under the Bourbons the excavations were carried out on a very unsatisfactory plan. Statues and articles of value alone were extricated, whilst the buildings were suffered to fall into decay or covered up again. To the short reign of Murat (1808–15) we are indebted for the excavation of the Forum, the town walls, the Street of Tombs, and many private houses. The political changes of 1860 have likewise produced a beneficial effect. The Italian government has since that date undertaken the prosecution of the excavations, and a regular plan has been adopted, according to which the ruins are systematically explored and carefully preserved. A local museum and library have been instituted, and a railway constructed for the removal of the *débris*. Signor Fiorelli, the able director of the excavations, has calculated that at the average present rate of working the whole city will not be exposed before the middle of the twentieth century.

The town is built in the form of an irregular oval, extending from east to west. The circumference of the walls amounts to 2925 yards. There are eight gates, to which the following names have been given: Porta di Ercolano, della Marina, di Stabia, di Nocera, del Sarno, di Nola, di Capua, del Vesuvio. Towards the sea the walls, which were built of large uncemented blocks of volcanic tufa and travertine, have been demolished. Outside the Porto di Ercolano a considerable settlement had sprung up, termed Pagus Augustus Felix, after the settlement established by Augustus. The area inclosed within the walls is estimated at 160 acres; greatest length, $\frac{3}{4}$ mile; greatest breadth, $\frac{1}{2}$ mile. The excavated part includes probably the most important part of the town, comprising the Forum, with the contiguous temples and public buildings; two theatres with large porticoes, the amphitheatre, and a considerable number of handsome private dwellings. The principal streets have been called the Via Domitiana, the Strada di Mercurio, delle Terme, della Fortuna, dell' Abbonanza, dei Diadumeni, dell' Anfiteatro, Stabiana. These streets, bordered by pavement, are straight and narrow, not above 24 feet broad, the narrower lanes being about 14 feet. They are admirably paved with large polygonal blocks of lava. At intervals, especially at the corners, are placed high stepping-stones, leading from one side of the pavement to the other, intended for the convenience of foot-passengers in wet weather. The waggons have worn deep ruts in the causeways, which do not exceed $4\frac{1}{2}$ feet in width. At the corners of the streets are public fountains, decorated with the head of a god, a mask, or similar ornament. The houses are slightly constructed of concrete, or bricks occasionally, especially the corner pillars of tufa blocks. The hasty patchy style of construction is accounted for by the earthquake of 63. The numerous and well-preserved staircases prove that the houses must have had a second, perhaps a third story. These upper portions, consisting chiefly of wood, have, with a single exception, been destroyed by the red-hot scoriae of the eruption. The front of the ground-floor of the larger houses was generally occupied by shops; where there were no shops the outer walls were stuccoed and generally painted, often in bright colours; the upper floors alone had small windows, owing to the absence of glass. The chief peculiarity of the habitations is the internal court, which provided the surrounding chambers with light, and was the medium of communication between them. Most of those Pompeian houses which belonged to the wealthy middle-class are

entered from the street by a narrow passage (*vestibulum*) leading to the court (*atrium*), surrounded by a covered passage, with the *impluvium* or reservoir for rain-water in the centre. Beyond the atrium is a large apartment opening on to it, termed the *tablinum*, in which the patron received his clients, transacted business, &c. The other portion of the house was devoted to the use of the family. Its centre also consisted of an open court inclosed by columns, thence called the *peristylum*, the middle of which was laid out as a garden. Beyond the peristyle lay sometimes a private garden (*xystos*) surrounded by columns. At the back of the peristyle were sometimes several business-rooms, termed *œci*. Round these apartments are situated the sleeping and eating rooms, slaves' rooms, kitchen, cellar, &c. All the apartments are small; the walls are sometimes covered with paintings, generally of an erotic character. The plate gives a view of the atrium of a Pompeian house, and is also a fine representation of architectural polychromy. The shops were small, and all of one character, having the business part in front, and one or two small chambers behind. They were open to the street, and closed by wide sliding shutters or doors moving in grooves cut in the stone, in some instances upon an iron rail. In front the shops had a broad counter of masonry, with little steps at the end next the wall for the display of goods, and a small oven at the opposite end when the articles sold were food or drink. Many of these counters, covered with marble, and sometimes fitted up with earthen vessels for the sale of wine, oil, &c., are still preserved. Trade-signs like those of the present day are rare. In the streets are frequently seen notices painted in red letters, referring generally to municipal elections, and recommending some particular person as *sedile* or *duumvir*. The Forum, lying in the heart of the town, consists of an area or open space surrounded by buildings. On the north side stands the so-called Temple of Jupiter; on the west the Temple of Venus and the Basilica; on the south the three tribunals or courts of justice; on the east the edifice built by the priestess Eumachia, and called Chalcidicum (probably employed as an exchange), the Temple of Mercury, the Curia or Senaculum, and the Pantheon or Temple of Augustus. The inclosed area is 565 feet long and 119 feet broad; it is paved with large stone slabs, and is bordered by a colonnade. The other important public buildings are the Great Thermae, the Great Theatre, the Small Theatre or Odeum, the Temple of Isis, and the Greek Temple or Temple of Neptune (the most ancient building yet discovered), and the amphitheatre. Among the more interesting private buildings scattered through the town are the villa of Diomedes, in the Strada dei Sepolcri; the house of Sallust, in the Strada di Ercolano; the house of Pansa, that of Apollo, and that of the Tragic Poet, in the Strada delle Terme; the house of Meleager, and that of Castor and Pollux, in the Strada di Mercurio; the house of the Faun, in the Strada della Fortuna; the house of Marcus Lucretius, in the Strada di Stabia. The houses have received these names from inscriptions, statues, or paintings found in them. The museum of Naples owes its most interesting features to the manuscripts, coins, statues, paintings, domestic utensils, &c., found in the public and private edifices above mentioned. See Sir W. Gell's *Pompeiana* (four vols. 1824–30); Dyer's *Pompeii* (1867); Rolfe's *Pompeii, Past and Present* (1884); Mazois' *Les Ruines de Pompéii* (4 vols. folio, Paris, 1812–38); Fiorelli's *Pompeianarum Antiquitatum Historia* (2 vols. 1860–62); &c.

POMPEY (CNEIUS POMPEIUS), surnamed the Great (*Magnus*), born B.C. 106, was the son of Cneius Pompeius Strabo, an able general, but hated for his

severity and avarice. In *b.c.* 89 he served under his father in the war against the Italian allies, fighting with great distinction until the general's death in 87. For some years subsequently the party of Marius was in the ascendant in Italy, and Pompey, who belonged to the aristocratic party, kept in the background. As soon as he learned, however, that Sulla was about to return from Greece to Italy, he hastened into Picenum, where his estates lay, and raised an army of three legions, with which he successively defeated three generals of the opposite party, who attempted to prevent his junction with Sulla. That junction was accomplished in 83, and Sulla received the young soldier with the greatest marks of esteem, saluting him as *imperator*, although he had not yet reached the senatorial age, being but twenty-three years old. When the war in Italy was brought to an end Pompey was sent to Sicily against the Marian general, M. Perperna Vento, whom he soon drove from the island (82). The following year he crossed over to Africa, where the Marian party had collected a force under Cn. Domitius Ahenobarbus, with whom was leagued Hiabas, king of Numidia. At the head of five legions Pompey came suddenly upon the enemy and completely routed them, killing Domitius and taking Hiabas captive. This decisive success, which occupied only fourteen days, excited the jealousy of Sulla, who commanded him to dismiss his forces and return to Rome. On his return he was received by the people with great enthusiasm, and Sulla greeted him with the surname of Magnus, which he continued to bear afterwards, and which descended to his sons. Not content with this empty distinction, Pompey demanded a triumph, which Sulla at first refused, but fearing his young rival's increasing popularity, at last consented to. Pompey therefore entered Rome in triumph in September, 81, before he was twenty-five years of age, and was the first Roman permitted to do so without possessing a higher dignity than that of equestrian rank. After the death of Sulla in 78 new troubles broke out, occasioned principally by the ambitious projects of the consul Lepidus, who aimed at the supreme power. When Lepidus had recourse to arms in 77, Pompey took an active part in the war against him, and with the assistance of the consul Catulus, at last succeeded in crushing him and his party. On quiet being restored Catulus called upon Pompey to disband his troops. This he evaded under various pretexts, until the progress of Sertorius, formerly a general in the service of Marius, induced the senate, though with reluctance, to send him to the aid of Metellus Pius, who was hard pressed by Sertorius in Spain. Pompey remained in Spain between five and six years (76-71), but neither he nor Metellus could gain any advantage over Sertorius. But when the latter was treacherously murdered by Perperna, his own officer, the war was speedily brought to a close. Pompey easily defeated Perperna in the first battle, and all Spain was subdued by the early part of 71. On his return to Italy at the head of his troops Pompey found the servile war raging. Crassus had already gained a decisive victory over Spartacus, the rebel leader, and all that Pompey had to do was to cut to pieces the scattered fugitives he came up with on his advance to Rome. For this he claimed the glory of having finished the servile war, and the honour of a second triumph. He now became a candidate for the consulship, and the people were so charmed with the successes of the young general, that although he was not of the legal age, and had not held any of the lower offices of the state, he was elected consul along with Crassus at the end of the year 71. The aristocracy began to look upon Pompey with jealousy, and ceased to regard him as belonging to their party,

as he and his colleague openly courted the people—Crassus, by his profuse largesses, and Pompey by the restoration of the tribuneship and other popular institutions. In 67 he was invested with extraordinary powers by sea and land for three years, for the purpose of putting an end to the outrages of the pirates who were then masters of the Mediterranean. He made his preparations for the war in the end of winter, entered upon it in the beginning of spring, and by the middle of summer he cleared the sea of the pirates, and destroyed their strongholds on the coast of Cilicia. Over 20,000 pirates were taken prisoners, many of whom he settled at Soli in Cilicia, which was henceforward called Pompeiopolis. Meanwhile the war against Mithridates had been carried on with various fortune, and the Romans were beginning to get discontented with the slow progress of Lucullus. The tribune, C. Manilius, proposed that the command should be given to Pompey, who was to have absolute power over the army and fleet in the East, and proconsular authority over all Asia as far as Armenia, a proposal which was supported by Cicero in the famous oration *Pro Lege Manilia*. It was opposed by the whole influence of the aristocracy, but carried triumphantly. In the four years 65-62 he conquered Mithridates; Tigranes, king of Armenia; and Antiochus, king of Syria. At the same time he subdued the Jewish nation, taking Jerusalem by storm after a three months' siege. He returned to Italy in 62, and immediately disbanded his army, but did not enter Rome till the following year, when he had the honour of a third triumph. From this date, when he was forty-five years of age, his star began to wane. He was now called upon to play a prominent part in the civil commotions of the state, a rôle for which neither his natural talents nor his previous training in the least suited him. The aristocracy still looked upon him with distrust, yet he was unwilling to throw in his lot entirely with the popular party, which had been steadily rising in power during his absence, and over which Cæsar now possessed unlimited control. The senate, who hated and feared him, refused to sanction his measures in Asia, and to make an assignment of lands which he had promised to his veterans. Pompey therefore resolved to ally himself closely with Cæsar, who promised to obtain the ratification of his acts provided Pompey would assist him in the attainment of his ends. Through the mediation of Cæsar Pompey became reconciled to Crassus, who, in consequence of his enormous wealth, had a wide influence in Rome. Thus was brought about the coalition of these three powerful men, which is known in Roman history as the first triumvirate, and which for a time swept away all the opposition the aristocratic party could organize against it. During Cæsar's consulship all his measures were carried. Pompey's acts in Asia were all ratified, and Cæsar's agrarian law, which partitioned the Campanian land among the poorer citizens, enabled Pompey to fulfil his promises to his soldiers. In order to tighten the bonds of alliance Cæsar bestowed upon Pompey his daughter Julia in marriage. It was soon apparent that this alliance would not last long. While Cæsar spent the next few years reaping laurels in Gaul, Pompey was gradually losing the confidence of all parties at Rome; yet he could not bear the thought of being the second man in the commonwealth, and he struggled hard to obtain the dictatorship. The death of Julia in 54 severed one of the ties which bound the two men who were soon to become open and deadly rivals. In consequence of the serious tumults which broke out in Rome on the death of Clodius in the beginning of 52, the senate called in the assistance of Pompey, who was appointed sole consul for that

year, and who succeeded in restoring order in the city. The most important state offices were now filled with Cæsar's enemies, and Pompey persuaded the senate to pass a decree by which Cæsar was to give up the provinces of which he was governor, and the command of his army. This he refused to do unless Pompey would throw up his offices, which was a step the latter would not take. Cæsar was proclaimed an enemy to the state, and his rival was appointed general of the army of the republic. Cæsar crossed the Rubicon in 49, and in sixty days he was master of Italy without striking a blow. Pompey fled to Greece, where he collected a numerous army, and whither he was followed by Cæsar in January, 48. At first the campaign was in Pompey's favour; Cæsar was repulsed before Dyrrhachium with considerable loss, and was compelled to retreat towards Thessaly. In this country, on the plains of Pharsalia, occurred the decisive battle which made Cæsar master of the Roman world. His rival fled to Egypt, where he hoped to meet with a favourable reception, as he had restored the young king's father to his kingdom. The Egyptian ministers, dreading Cæsar's vengeance if they favoured his enemy, resolved to get Pompey into their power and put him to death. Accordingly while he was sailing along the coast a boat was sent out to his ship, and he was invited to land. As he was about to step on shore he was stabbed by one of his former centurions (29th September, 48). His head was struck off, and was shown to Cæsar when he arrived in Egypt some time afterwards. He turned away from the sight with tears, rewarded his followers liberally, punished his murderers, and erected over his remains a temple to Nemesis.

POMPEY'S PILLAR, a celebrated column, standing on an eminence about 1800 feet to the south of the present walls of Alexandria in Egypt. It consists of a capital, shaft, base, and pedestal, which last rests on substructions of smaller blocks once belonging to older monuments. One of these blocks bears the name of a monarch of the thirteenth Egyptian dynasty, and another that of Psammeticus I. The total height of the column is 98 feet 9 inches; the shaft, a monolith of red granite, is 73 feet long, and 29 feet 8 inches in circumference. The shaft is elegant and of good style, but the capital and pedestal are of inferior workmanship, and have the appearance of being of a different epoch. The name it is popularly known by was applied to it by ancient travellers for no assignable reason. An inscription on the base shows that it was erected by Publius, the prefect of Egypt, in honour of Diocletian, probably to commemorate his capture of Alexandria, and the suppression of the rebellion of Achilleus. On the summit there is a circular depression of considerable size, intended to admit the base of a statue; and, indeed, in an old picture of Alexandria the figure of a man is represented as standing on the column. Arabic writers state that it stood in a *stoa* surrounded by 400 columns, where the library was contained which Omar burned.

POMPONIUS MELA. See **MELA**.

PONCE DE LEON, JUAN, one of the early Spanish discoverers in America, accompanied Columbus on his second expedition in 1493, and was sent by Ovando to conquer the island of Porto Rico. Having there amassed great wealth, and received information of an island situated to the north, in which there was a miraculous fountain possessing the power of restoring youth to the aged, he sailed in 1512 in quest of these happy shores. Although he was unable to find the fountain of youth, he discovered the country to which he gave the name of Florida. Ponce returned to Spain in 1518, and was appointed by Ferdinand governor of the island of

Florida, as he called it, on condition that he should colonize it. In 1521 he embarked nearly all his wealth in two ships, and proceeded to take possession of his province. He was, however, met with determined hostility by the natives, who on one occasion made a sudden attack upon the Spaniards, and drove them to their ships. In the combat Ponce de Leon was mortally wounded, and died after his arrival at Cuba in 1521.

PONCE DE LEON, LUIS, a Spanish lyric poet, born in 1527, probably at Granada. He entered the order of St. Augustine at the age of sixteen, became licentiate in theology in 1560, and doctor of divinity shortly afterwards. At the age of thirty-four he was appointed professor of theology at Salamanca, and ten years later obtained the professorship of sacred literature. At the request of some friends he translated the Song of Solomon into Castilian, and the manuscript falling into the hands of some persons who were envious of his talents and success he was brought before the tribunal of the Inquisition at Valladolid, in 1572, on the charges of Lutheranism, and of translating the sacred writings contrary to decrees of the Council of Trent. The first charge could not be sustained against him, but as he could not deny the second he was thrown into prison. At the end of five years he was liberated and reinstated in all his offices in the university, where, in December, 1576, he resumed his lectures after the long intermission with the simple remark: 'As we observed in our last discourse.' At the time of his death (23d August, 1591) he had just been elected head of his order, and was drawing up regulations for its reform. His original productions, which are not numerous, are chiefly of a religious character. They were first published by his friend Quevedo at Madrid, in 1631, under the title *Obras Proprias, y Traducciones*. They contain translations from Virgil, Horace, and other classical poets, and from the Psalms and the book of Job, and have been frequently reprinted. Among his most popular prose works are his *Perfecta Casada*, *De los Nombres de Christo*, &c. One of the best editions of his works is that published at Madrid, in six vols. (1804-16). See Ticknor's History of Spanish Literature.

PONCHO, a kind of cloak much worn by the male inhabitants of Chili and other parts of South America. It is a piece of thick woollen cloth from 5 to 7 feet long and 3 to 4 feet broad, with a hole in the centre for the head to pass through.

PONDICHERRY (French, *Pondichéry*), a town, capital of the French possessions in Hindustan, on the east or Coromandel coast, 85 miles south by west from Madras. Its territory is surrounded on the land side by the British district of South Arcot. It stands on a sandy beach, and consists of two divisions separated by a canal. The 'White Town,' or European quarter, on the east, facing the sea, is very regularly laid out, contains a spacious square, in which is the government-house, handsome planted boulevards, and a number of well-built houses, stuccoed white or yellow, mostly with terraces on their summits, and furnished with a colonnade below. The 'Black Town,' or native quarter, on the west beyond the canal, consists mainly of houses or rather huts of brick or earth, and a few pagodas. Its streets are broad and shaded by palm-trees, but, as usual with Hindu towns, it is filthy. A large bazaar, two churches, a lighthouse, a public library, college for European children, several other public schools, a botanic garden, and a mont de piété are the chief edifices and institutions. The fortifications, formerly strong, were destroyed during the war with the British, and by the Treaty of Paris they are not to be rebuilt, nor is Pondicherry to be garrisoned by a native French

forus. The territory around the town has an area of 107 square miles, and is partly watered by the Ginge River, but is not very fertile: some rice, indigo, tobacco, betel, cotton, and cocoa-nuts are raised; which, with cotton cloths, form the chief exports. The imports consist chiefly of manufactured goods. There is no harbour, but only a roadstead, where the surf beats almost as strongly as at Madras. There is, however, an iron screw-pile pier. The town has been provided with a good supply of drinking water. The settlement was purchased by the French from the Bejapoor rajah in 1672. It was several times taken by the British, the last being in 1803, being restored in 1815. Pop. (1895), 49,052.

PONDWEED. See **POTAMOGEON**.

PONIATOWSKI, the name of an illustrious Polish family descended from an Italian stock.—**GRUSSEFF SALINGUERRA** (born 1612), belonging to the old Italian family Torelli, having settled in Poland after the murder of all his house by Ranuzio I., duke of Parma, took the name of Eziolek, and afterwards that of Poniatowski, from an estate Poniatow of his wife, the daughter of Albert Poniatowski and Anna Lecinska. His descendants received the title of prince in 1764.—**STANISLAW**, Count Poniatowski (born 1678; died 1762), is known for his connection with Charles XII., whom, after the battle of Poltava, he followed into Turkey, and as whose ambassador at Constantinople he had the address to involve the porte in a war with Russia. He wrote *Remarques d'un Seigneur Polonois sur l'Histoire de Charles XII.* par Voltaire (Hague, 1741).—His eldest son, **STANISLAW AUGUSTUS** (born 1732), the favourite of Catharine II., was elected king of Poland, under the influence of Russian bayonets, in 1764. See **STANISLAW**.—**JOZEF**, the nephew of King Stanislaw, born in 1762, served with courage against the Russians in 1792, and on the accession of his uncle to the confederation of Targowitz, left the service with most of the best officers. When the Poles attempted in 1794 to drive the Russians out of their country, he again joined the Polish camp as a volunteer. Kosciuszko gave him the command of a division, at the head of which he distinguished himself at the two sieges of Warsaw. After the surrender of the city he went to Vienna, and, rejecting the offers of Catharine and Paul, lived in retirement on his return to Poland, at his estates near Warsaw. The creation of the Duchy of Warsaw rekindled the hopes of the Polish patriots, and Poniatowski accepted the place of minister of war in the new state. In 1809 he commanded the Polish army against the superior Austrian force which was sent to occupy the duchy, compelled it to retire, rather by skilful manoeuvres than by force of arms, and penetrated into Galicia. In the war of 1812, against Russia, he was again at the head of the Polish forces, and distinguished himself throughout this chequered campaign. After the battle of Leipzig, during which Napoleon created him marshal of France, he was ordered (October 19) to cover the retreat of the French army. The enemy were already in possession of the suburbs of Leipzig, and had thrown light troops over the Elster, when the prince arrived with a few followers at the river, the bridge over which had been blown up by the French. Poniatowski, already wounded, plunged with his horse into the stream, which swallowed up horse and rider. His body was first found on the 24th, and buried with all the honours of his rank on the 26th. It was afterwards removed to Warsaw, and in 1816 was deposited in the cathedral at Cracow. An equestrian statue of Poniatowski was erected for the city of Warsaw by Thorwaldsen.

PONTA-DELGADA, or **PONTE-DELGADA**, a town on the south side of the island of St. Michael, one of the

Azores, being the largest town in these islands. It is defended on the sea side, on the west by the castle of St. Braz, and about three miles to the east by the forts of São Pedro and Rasto de Cão. It is built with considerable regularity, and the houses have a substantial and cheerful appearance. The principal buildings are six churches, eight monasteries, and four convents, now suppressed, and a neat English chapel. The town has been lighted with gas since 1884. The harbour accommodation was formerly very defective, but the construction of a breakwater and other works has greatly improved it. The trade is considerable, and is chiefly in the hands of the British, of whom a considerable number are here resident. The chief exports are wheat, maize, and oranges; and the imports, cotton and silk tissues, hardware, &c. Pop. estimated from 16,000 to 20,000.

PONT-A-MOUSSON, a town of France, in the department of Meurthe-et-Moselle, 16 miles north-west of Nancy, on both sides of the Moselle, here crossed by a bridge. It has a fine square surrounded by arcades, a handsome Gothic church dedicated to St. Martin; the old abbey of St. Mary, now converted into a seminary; a communal college, and other educational institutions. It was the seat of a university from the year 1571 to the French revolution. It fell into the hands of the Germans in August, 1870, and was evacuated in 1873. Pop. (1896), 11,193.

PONTCHARTRAIN, a lake of Louisiana, about 5 miles north of New Orleans, about 40 miles long from east to west, and nearly 25 in breadth. The water is generally from 12 to 14 feet deep. It communicates with Lake Borgne on the east, with Lake Maurepas on the west, and with New Orleans on the south, by Bayou St. John and a canal, and also by a railroad. It is surrounded by marshes, and the landing is generally difficult.

PONTE-CORVO, a town of Italy, in the province of Terra di Lavoro, and 20 miles south-east of Frosinone, in an isolated territory, on the left bank of the Garigliano. It is the see of a bishop, and has a castle, a cathedral, and six other churches. It was the capital of a principality created by Napoleon I., and from which Bernadotte had his title of Prince de Ponte-Corvo. Pop. 9314.

PONTEFRAC, or colloquially, **POMFRET**, a municipal and parliamentary borough, and market town, England, in the county and 24 miles s.s.w. of York, on a height near the confluence of the Aire and Calder, with stations on the Midland, North-Eastern, and Lancashire and Yorkshire Railways. It is well built, mostly of brick, and among its edifices the parish church is conspicuous from its elevated site and lofty tower; there are also the remains of a more ancient church, and of a Norman castle, which was the scene of the murder of Richard II. and other atrocities. This was the last fortress to hold out for Charles I., and was dismantled in 1649. One of the hospitals of the town dates from Saxon times, being supposed to have been founded by Ethelburga, the queen of Edwin of Northumbria. The chief manufactures are iron and brass castings, earthenware, bricks, tiles, pipes, &c.; and there is considerable trade in malt, corn, and liquorice, particularly in the form of the small lozenges known and highly esteemed for centuries under the name of Pontefract cakes. There are large collieries, and also extensive gardens and nurseries in the vicinity. Pontefract has been a parliamentary borough since 1295. It long returned two members, but lost one of them in 1855. Pop. in 1881, mun. borough, 8798, parl. borough, 14,767; in 1891, 9702 and 16,407 respectively; in 1901, 13,422 and 20,742.

PONTEVEDRA, a town in Spain, Galicia, capital of a province of the same name, at the point where the

Lerez, Albe, and Tormes unite before falling into the Bay of Pontevedra in the Atlantic. It is surrounded by an old wall; consists of broad, well-paved streets, and well-built houses of granite, and has two churches, one of them a beautiful Gothic structure; and an old Franciscan convent, now used as a court-house. There are manufactures of cotton velvet, woollen and cotton cloth, hats, leather, &c.; fishing is actively carried on. Pontevedra was repeatedly sacked during the Napoleonic wars. Pop. 19,857.—The province, bounded on the south by Portugal, and on the west by the Atlantic, has a fertile soil and a good climate; produces in abundance maize, rye, wheat and millet, flax, fruit, and wine, and rears great numbers of cattle. Area 1739 square miles; pop. (1897), 447,612.

PONTHEIU, an ancient county of France, in the government of Picardie, bounded on the north by the river Canche, on the south by the Bresle, on the west by the Atlantic, and on the east by the county of Artois and the bailiwick of Amiens. It was traversed by the Somme from the south-east to the north-west, which divided it into North Ponthieu (or Ponthieu Proper) and South Ponthieu, or Vimeu. The principal towns of Ponthieu were Abbeville, the capital, Montreuil, Rue, St. Riquier, Cr  cy, and Le Crotoy; the principal town of Vimeu was St. Valery. The greater part of Ponthieu belonged originally to the Abbey of St. Riquier and other monasteries, but passed into the hands of counts, who became independent and hereditary towards the end of the tenth century. It passed by marriage to the counts of Alen  on about 1100, and was ravaged by Henry II. of England in 1168. In 1221 it came into possession of Simon Dammartin, count of Aumale. Between the years 1279 and 1435 it frequently changed hands, the contending parties being the English and French kings. In the latter year it was finally wrested from the English by Charles VII., and pledged by him to Philip of Burgundy. On the death of Charles the Bold, in 1477, the Burgundians were expelled, and the county was reunited to the French crown.

PONTIANAK, a town in the south-west of Borneo, on both sides of the Kapuas, here also called the Pontianak, where it receives from the north the river Landak, about 15 miles from the open sea. It is the capital of the Dutch residency of West Borneo, and is the seat of a native sultan. The town is one of the most important in Borneo, and though mostly built in native style, has also a certain number of European houses. Many of the native dwellings are built on piles planted in the river. The Dutch, Malays, Chinese, Bugis, &c., have each a quarter of their own, and the total population is estimated at from 18,000 to 20,000. The Dutch residency extends from the frontier of Sarawak southwards to the east of Cape Sambur, and on its coast are numerous islands. It is watered not only by the Kapuas and Landak, but by numerous other streams. It produces pepper, sago, rice, rattans, sugar, wax, birds'-nests, diamonds, and gold. Some cotton and silk stuffs are made; and opium, rice salt, cottons, and wares are imported.—The kingdom or sultanate is now limited to the delta of the river Kapuas. It is tributary to the Dutch, and has only a nominal independence.—The river rises in streams flowing from mountains near the centre of the island. It flows w.s.w. in a very crooked course, and after receiving numerous tributaries falls into the sea by various mouths; total direct course about 350 miles.

PONTIFEX, a priest who served no particular divinity. The Roman pontifices formed the most illustrious among the great colleges of priests. Their institution, like that of all important matters of religion, was ascribed to Numa. This king limited

the number of pontifices to four, exclusive of the *pontifex maximus* or chief priest. The Ogulnian Law (300 B.C.) raised this number to eight, or including the *pontifex maximus* to nine, four of whom were to be plebeians. Sulla increased the number to fifteen, and Julius C  sar to sixteen, including in both these instances the *pontifex maximus*. The duty of this dignitary was the inauguration of the priests, and in earlier times the care of the public records (*annales maximi*). He also superintended the sacred rites of Vesta. He held his office for life, and could not leave Italy. The emperors afterwards assumed this title until the time of Theodosius, and it was subsequently assumed by the Christian Bishop of Rome. The pagan pontifices had the supreme superintendence of the religious worship and its ministers, directed the religious solemnities, had the care of the calendar, and decided lawsuits which were connected with religion (hence the *jus pontificum*). The external badge of the pontifex, at least on solemn occasions and while engaged in the duties of his office, was a dress bordered with purple (*toga pretexta*), and a tapering hat in the form of a cone, which was made of the skins of sacrificed animals (*tutulus* or *galerus*).

PONTIFICAL, the book containing the prayers and rites to be used by the pope and bishops in the exercise of their functions, as confirming, conferring orders, consecrating bishops and churches, &c. Some writers have maintained that the Roman Pontifical is the work of Pope Gregory the Great, while others attribute its formation to Pope Gelasius, who flourished a century before him. The true account of it seems to be that which assigns its first form to Gelasius, while it was recast by Gregory, who made a considerable number of emendations upon it in the way of deletions, modifications, and additions. In this form, with a few subsequent alterations, and as published by the authority of Clement VIII., in 1596, it is used at the present day throughout the whole of the Western Church.

PONTIFICATE. The pope being called *pontifex*, the time of his government is called his *pontificate*.

PONTINE MARSHES (Italian, *Paludi Pontine*; Latin, *Pomptina Paludes*), an extensive tract of land in Italy, south of Rome, stretching along the coast. In its widest extent it stretches from Nettuno to Terracina, and has a length of 30 miles, with a mean breadth of 7; but only a portion of this area is marsh properly so called. The origin of these marshes is lost in the most remote antiquity. It is assumed that they were once covered by the sea, from the circumstance that Homer describes the abode of Circe, which is conceived to be what is now known as Monte Circeo, as an island. From physical considerations, however, it is concluded that their formation must be assigned to a date considerably anterior to that usually assigned to Homer. In the early times of the Roman Republic there were, according to Pliny, on the testimony of former historians, thirty-three cities situated in this region, all of which disappeared at a very early period. It is doubted, however, whether this account is worthy of credit, as well from the improbability of the thing in itself, as from the fact that it receives no corroboration from any other early historian, and not even the names of any of the cities are preserved. The marshes, which are generally represented as deriving their name from the city of Suessa Pometia, situated somewhere on their borders, are formed by innumerable streams, which, rising in the neighbouring mountains, run into the plain, where, for want of a sufficient declivity towards the sea, they pass off very slowly, become stagnant, and at length lose themselves in the sand. The loss of so great a portion of fertile land, and the unwholesome vapours, which the south

wind often carried even to Rome, early attracted the attention of the Romans, and they sought to devise some scheme for remedying this evil. Appius Claudius (312 B.C.) probably made the first attempts at draining them when he carried the celebrated Appian Way through the marshes. He was succeeded in this attempt by the consul Cethegus (180 B.C.) Julius Cæsar formed the gigantic plan of conducting the Tiber through the marshes; but he was prevented by death from its execution. Augustus contented himself with undertaking several canals. Under the succeeding emperors these attempts to improve this part of the country were abandoned; and the water overflowed, till Nero renewed the work. Trajan continued it during ten years with so much spirit that the whole tract from Treponti to Terracina was drained, and the Appian Way was completely restored. During the political storms which destroyed the Roman Empire the marshes also reverted to their former dreary condition. Under the Gothic king Theodoric attempts were once more made to drain them, and, as it appears, not without success. But the operations were not long persevered in, and hostile nature soon resumed her rights. Among the popes, Boniface VIII. (who died in 1303) was the first who occupied himself with the draining of the marshes; and he caused a large canal to be dug, by means of which the country around Sezze and Semonetta remains dry even to this day. Martin V., in 1417, likewise caused a great canal, the Rio Martino, to be dug, for the extension of which to the sea hardly a mile was wanting, when this undertaking, which would have supplied an outlet for all the streams, was interrupted by his death. The next important attempt was that of Pius VI., who spent ten years (1778–88) in systematic efforts for reclaiming the marshes, and constructed the present fine road across them. Canals were cut, the beds of the different streams were cleansed, and the line of the Appian Way, abandoned for centuries, was partly restored. The submerged part, which had previously reached about 50,000 acres, was greatly reduced in area. The administration of the first French empire laboured in like manner at the draining of the marshes, from 1810 to 1814, when the operations were stopped through the fall of Napoleon. But notwithstanding all these labours and the efforts of modern proprietors, this region remains a hotbed of malaria and fever. Considerable areas of it, however, serve to pasture cattle and horses, and the marshier portions are congenial spots for the buffaloes kept by the Italian farmer. Among the more recent proposals for reclaiming this region are those put forward by Von Donat in 1895.

PONTOISE, a town of France, in the department of Seine-et-Oise, picturesquely situated at the confluence of the Viosne with the Oise, here crossed by a handsome bridge, about 16 miles north-west of Paris, and 19 miles north of Versailles. The houses are tolerably well built, but most of the streets are narrow and steep. Its chief edifices are the church of St. Maclou, the public library, and a magnificent hospital. The town dates from Roman times, and has played a somewhat prominent part in French history. Pop. (1896), 7580.

PONTOON, in military engineering a flat-bottomed boat, or any light and buoyant framework or floating body, used in the construction of a temporary bridge for the passage of troops over a river or arm of the sea. As pontoons form a part of the equipment of an army they must be as light in structure as is consistent with safety. The pontoons used by armies have differed greatly at different times, the two chief types being a kind of undecked boat, and a decked boat or close cylinder. Recently in the British army

the pontoons were of tin, and cylindrical in shape. At present they are in the form of a partially decked boat or *décau* of wood of light construction, the sides and bottom being of thin yellow pine, covered on both sides with canvas. A distance of 15 feet is left between each pontoon. The introduction of pontoons may be considered to date from the eighteenth century, although long previous to this similar means were used for the passage of streams. Darius passed the Hellespont and Danube by pontoon bridges. Xerxes likewise made the passage of the Hellespont with his vast army by similar means.

PONTOPPIDAN, ERIC, the younger, born at Aarhus 24th August, 1698; died 20th December, 1764. After acting as pastor at different places in Schleswig and Seeland he became preacher to the court in 1735, and soon after professor of theology in Copenhagen, in 1747 Bishop of Bergen, and in 1755 chancellor of the University of Copenhagen. As a theologian he favoured the pietism of Spener, and some of his works on this system of doctrine, especially his *Helle Glaubenspiegel*, are still in the hands of the people. His *Menoza* (three vols. 1742), one of the first theological romances, is especially valuable on the account of its attractive characterization of some of his celebrated contemporaries. His works on church history, such as his *Annales Ecclesiæ Daniæ* (four vols. Copenhagen, 1741–52), contain a great mass of valuable materials. He also enriched history in general by his *Marmora Danica* (two vols. 1739–41), *Gesta et Vestigia Danorum extra Daniæm* (three vols. Leipzig, 1740–41), *Origines Hafnienses* (1740), and his *Danske Atlas* (seven vols. Copenhagen, 1763–81). His learning was very comprehensive; for instance, his *Glossarium Norvagicum* (Bergen, 1749) was a valuable contribution to the science of language, as was his *Forsøg til Norges naturlige Historie* (Copenhagen, 1752–54; Essay on the Natural History of Norway, translated into English, London, 1755) to natural history.

PONTUS, in Asia Minor (so called from the Pontus Euxinus, on which it lay), the country extending from the Halys to Colchis. Its limits underwent at first considerable changes, and when finally fixed it bordered in the west on Paphlagonia, where the Halys formed the boundary; in the south on Galatia, Cappadocia, and Armenia Minor, the Antitaurus, and Mount Paryadres being the boundaries; and in the east on Colchis and Armenia, from which it was separated by the river Phasis. The country on the east and south is mountainous, but along the coast there are large and fertile plains. According to Strabo great varieties of excellent fruit were produced, and game abounded. The oldest inhabitants were Tibarenes and Chalybes. A son of the Persian king Darius, Artabazes, received Pontus as a separate satrapy, with the right to transmit it as an inheritance to his posterity. One of his successors, Mithridates (about 400 B.C.), assisted the younger Cyrus, and refused to pay tribute to Artaxerxes. His son, Ariobarzanes I. (363–337), made himself independent during the general insurrection of the governors of Asia Minor against Artaxerxes II. Mithridates II. (337–302) transferred his kingdom voluntarily to Alexander. Afterwards, in the division of his empire in 322, it fell to Antigonus, who, having attempted the death of Mithridates, the latter fled to Paphlagonia, where he found adherents, and successfully maintained himself. His successor, Mithridates III. (302–266), enlarged his paternal kingdom by conquests. Mithridates III. was succeeded by his son Ariobarzanes III., who reigned from 266 to about 240 B.C., and he again by his son Mithridates IV., whose reign extended to about 190 B.C. The latter drove back the Gauls, who at various

times in the course of the third century B.C. invaded Asia Minor, and formed settlements there, and who made an attack upon Pontus shortly after the accession of Mithridates IV. He also attacked Sinope, but was unable to take it. Pharnaces I., who succeeded Mithridates IV., and reigned till about 156 B.C., at length took possession of Sinope, and made it his residence. Mithridates Euergetes, father of the celebrated Mithridates, aided the Romans in the third Punic and in the Pergamian war, and received from them Phrygia Major. He was murdered about 124. His son, Mithridates the Great, succeeded him. During his reign the territory of Pontus was increased by the addition of the Cimmerian Bosporus, a small kingdom nearly corresponding to the modern Crimea, which the last king voluntarily ceded to Mithridates. But it was during the same reign that the kingdom of Pontus itself came to an end. Mithridates carried on bloody wars with Rome until his death; at last he submitted to Pompey, and killed himself, B.C. 63, from despair. The western part of Pontus was then annexed to Bithynia, and the remaining parts given away to the chiefs of some of the adjoining states. Pharnaces II., the treacherous son of Mithridates, obtained only Bosporus, and when he attempted to conquer again his paternal kingdom was vanquished by Cæsar, and put to death by Asander, who had made himself King of Bosporus. Still his son Darius received through Antony a part of Pontus. Polemon, who at the same time possessed the Kingdom of Bosporus, Asia Minor, and Colchis, was his successor. After the death of his widow, Pythodoris, Polemon II. succeeded, as King of Pontus, A.D. 39. Nero took Bosporus from him, and Pontus, under the name of Pontus Polemoniacus, became, after Polemon's death, a Roman province. When the Latins in 1204 again conquered Constantinople Alexius Comnenus founded a new kingdom in Pontus, which remained until Mohammed II. united it in 1461 with his great conquests.

PONTUS EUXINUS, the ancient name for the Black Sea (or Euxine). The Greek name *Euxinos pontos* signifies *hospitable sea*, and is supposed to have been substituted for the older name *Axeinos* (inhospitable) from superstitious motives.

PONTYPOOL, a market-town of England, in the county and 15½ miles south-west of Monmouth. It is irregularly built; has numerous places of worship; a town-hall; large intermediate education schools; fine new markets, &c. Many of the population are employed in the calico, iron, steel, and tinplate industries. Pop. in 1891, 5842; in 1901, 6126.

PONTYPRIDD (formerly **NEWRRIDGE**), a market-town of Wales, in the county of Glamorgan, situated on the Taff at its junction with the Rhondda, 12 miles N.W. of Cardiff. The Taff is crossed here by a celebrated bridge having an arch of 150 feet span. The inhabitants are chiefly engaged in the iron and brass foundries, the manufacture of heavy iron goods, chemical works, and coal and iron mines. Pop. (1881), 12,317; (1891), 19,971; (1901), 32,319.

PONY, a term applied to several sub-varieties or races of horses, of smaller size than the ordinary breeds of horses, and which are bred in considerable numbers in various parts of the world, chiefly for purposes of riding and of lighter draught work. Ponies may be said to unite in themselves the beauty, strength, and hardness of their larger neighbours. Of the breeds of ponies the best known and most valued are the Welsh and the Shetland. The head of the Welsh pony is small, the withers high, the body rounded and deep, the legs flat, and the hoofs and ears small. The Shetland pony is generally smaller than the Welsh, the shoulders being thick and low, and the limbs very stout and powerful. Other

breeds come from Iceland, Exmoor, the New Forest, and the Scotch Highlands. The Galloway Horses of Scotland were a breed of very strong hardy ponies, sometimes attaining a height of 14½ hands.

POODLE, a well-known species of dog, originally German, but now abundant in all parts of Europe. There are two varieties, but the only difference between these is in point of size, the one being larger than the other. The body of the poodle is thick and short; the head large and round; the ears long and pendent; the tail somewhat short; the hair long, curled all over the body, and generally of a black colour or spotted black and white, sometimes it is all white. Of all dogs the poodle is the one whose intelligence seems most susceptible of development, and which exhibits most affection for its master. Its scent is good; it is fond of the water, and swims with great ease, which causes it to be frequently employed in hunting aquatic birds. It is very easily trained.

POOLE, a seaport, municipal and former parli. borough of England, in the county of Dorset, in the north part of Poole Harbour, and on a branch of the London and South-Western Railway. It is a very ancient place, with many barrows and other early antiquities in its vicinity; and had fortifications, which were demolished in the time of Charles II. The old town is being surrounded by handsome suburbs at a rapid rate. Among the chief buildings are an elegant modern parish church, several Non-conformist chapels, a town-hall, a guild-hall, and a custom-house. The manufactures consist chiefly of cordage and sail-cloth; there are also potteries, large flour-mills, and two iron-foundries. The harbour is large and commodious, with excellent quays and extensive warehouses. There are yards for building ships, and valuable plaice and herring fisheries. The shipping trade is considerable, especially coastwise. The chief exports are clay for the Staffordshire potteries, and manufactured clay goods. Poole lost its separate parliamentary representation in 1885. Pop. in 1881, 12,310; in 1891, 15,438; in 1901, 19,461.

POOLE, MATTHEW, the well-known compiler of the Synopsis Criticorum Biblicorum, was born at York of a good family about 1624, studied at Emmanuel College, Cambridge, and took orders. In 1662 he was ejected by the Act of Uniformity from his church of St. Michael-le-Querne in London, and turned his leisure to good account by spending ten years on his Synopsis, which is an attempt to condense into one work the opinions of all the biblical critics of all times and countries previous to his own. The work extended to five large folio volumes, and indicates great labour and research as well as no small degree of learning; but it is now of little use, later criticism and research having done much to supersede it. Poole also wrote Annotations on Scripture, and took an active part in the leading controversies of his time, especially those with the Socinians and Roman Catholics. The intolerant spirit of the Stuarts compelled him to seek an asylum at Amsterdam, where he died in 1679.

POONAH, or **PUNA**, a city and district of Hindustan in the presidency of Bombay. The city, in a plain about 2000 feet above the sea, 119 miles eastward from Bombay by the Great Indian Peninsula Railway, stands at the junction of two affluents of the Bhima River (the Mula and Muta), and wears a somewhat European aspect. It is pretty well built; most of the houses are of more than one storey, the walls consisting of a framework of wood filled in with brick or mud, and the roofs being tiled. Its main street is wide, and lined with buildings ornamented with paintings and carvings; it has numerous pagodas; the Deccan college for classics,

mathematics, and philosophy; and a college of science, with special training in civil engineering; a training college for teachers of vernacular and Anglo-vernacular schools, a female normal school, a government first grade high school, besides other schools; legislative council hall, public library, civil hospital, arsenal, and barracks. The European cantonments are on the north, and here most of the Europeans reside. In the town are the ruins of the palace of the Peishwa or head of the Mahratta confederacy, whose capital was Poonah. This station is famed for salubrity, and from July to November is the seat of the Bombay government. It is an important military post, and has some manufactures of silver and gold jewelry, combs, dice, and other small articles of ivory, silk and cotton fabrics, and articles of brass, copper, iron, and clay. Good roads connect it with Bombay, Ahmednagar, Sattarah, &c. Important works supply Poonah with water from the Mula Valley, 10 miles above Poonah. The annual rainfall averages 22 to 25 inches, being about a fourth of the average fall at Bombay. Pop. in 1881 (with cantonment), 129,751; in 1891, 160,460; in 1901, 111,385.—The district is bounded on the north by the district of Ahmednagar, west by the Ghauts, separating it from the Concan, south by Sattarah, and east by the Nizam's Dominions. Area, 5348 square miles. It is an elevated table-land, watered by the Bhima and its tributaries, and abounding in isolated heights, formerly crowned with strong fortresses. The villages are mostly open, but sometimes surrounded by hedges of cactus. Inhabitants chiefly Mahrattas. After Poonah the principal towns are Serur, Paidgaon, Solapur. Pop. (1891), 1,067,800

POON WOOD is the timber of the poon tree (*Calophyllum inophyllum* and *Calophyllum angustifolium*), a native of India. It is of a light, porous texture, and is much used in the East Indies in ship-building for planks and spars. The Calcutta poon is preferred to that of other districts.

POOP (Latin, *puppis*), the aftermost and highest part of the hull in large vessels; also a deck raised over the after-part of a spar-deck, sometimes called the *round-house*. Ships formerly had several poops, the one above the other. The tendency now is to dispense with the poop altogether on account of the obstruction it presents to the ship's progress through catching the wind.

POOR AND POOR'S LAWS. Poor, in the special sense in which we take it here, is a term used in reference to one who lacks the means necessary for his subsistence. At no period in the whole history of the world, and amongst no people, can there be said to have existed no poor. So long as a man is liable to become dependent on others for the means of his subsistence, so long is he liable to poverty. The history of pauperism presents us with much that is interesting. In Egypt, where the system of caste, which was afterwards so fully developed in India, originated, the lower classes, as far back as history takes us, were doomed to poverty, while luxury and profusion were reserved for the priests and warriors, who constituted the upper classes. The famine which arose under the eighteenth dynasty obliged the Egyptians to sell their persons or their labour to the kings, by whom they were treated as mere machines. Babylon and Nineveh present us with a similar spectacle; enormous wealth amongst the great, and penury and servitude amongst the humbler classes. In Persia the people, according to Herodotus, were distributed into ten tribes, and the three lowest of these were in a state of poverty. Greece presents us with the aspect of a small number of citizens with an enormous number of slaves. But even amongst the citizens poverty and misery

must have existed to a great extent; for although the historians are reticent upon this point, there is little doubt that this was one of the main causes of such frequent emigrations, resulting in the establishment of many colonies along the Italian and Asiatic shores and elsewhere, as also for the law that in Sparta permitted the poor to expose their infants. In Rome, in its earlier days at least, the contest between the plebeians and the patricians partook very much of the nature of a struggle between poverty and riches. Surrounded by enemies, and almost constantly engaged in warfare, which subjected the cultivators of the soil to have their lands and houses frequently pillaged, and the fruit of their labours all destroyed, many were plunged into abject poverty, and the severe laws regarding debtors only served to increase their misery. Only the patricians, as a rule, were able to lend money, and thus the contest between debtors and creditors was in its origin identical with that between the plebeians and the patricians. As Rome extended, the gulf between the poor and the rich became still wider, notwithstanding the agrarian laws enacted with a view to remedy this evil. The unsettled state of the country following the downfall of the Roman Empire must have been the occasion of an incalculable amount of misery. In 994 the plague desolated the centre of France. In 997 the starving peasantry rose in rebellion against the nobles. From 1030 to 1033 thousands were cut off by famine. During the middle ages the great majority of the people were in a state of bondage to their feudal superiors, who, however, were obliged to attend to the maintenance of the serfs, and many freemen, in order to avoid destitution, surrendered their liberty and became serfs.

In all the countries of modern Europe laws have been enacted relative to the maintenance of the poor; but in this article we shall confine ourselves to British legislation on the subject. The poor recognized by the law are the poor by impotency and defect; the poor by casualty; and the poor by prodigality and debauchery, also termed the thrifless poor. In England, up to the time of Henry VIII., as also in all the continental countries, the poor subsisted entirely on private benevolence, one of their chief resources being the monasteries. But the charity exercised by these institutions, however commendable in certain respects, had the radical defect of encouraging rather than repressing mendicity, and when the institutions themselves were swept away by the reforming measures of Henry VIII., thousands of these poor dependent upon them were thrown upon the country at large for their subsistence. Numerous statutes were passed in the reign of Henry VIII. and following reigns to provide for the poor and impotent, who appear from the preambles of some of these to have increased at that time to a very considerable extent. These poor were principally of two classes: the sick and infirm, who were unable to work; and the idle and sturdy, who did not choose to work. To provide in some measure for both of these in and about the metropolis, Edward VI. founded three royal hospitals; Christ's and St. Thomas' for the relief of the impotent; and Bridewell for the punishment and employment of the vigorous and idle. But these were far from sufficient to meet the requirements of the kingdom at large. Accordingly other measures were adopted, and after a number of fruitless experiments 43 Eliz. cap. ii. (1601) provided for the appointment in every parish of overseers of the poor, whose chief duties were: first, to raise competent sums for the necessary relief of the poor, impotent, old, blind, and others who were poor and not able to work, and them

only; and, secondly, to provide work for such as were able and could not otherwise find employment. For these purposes they had power to levy rates upon the inhabitants of the parish. The overseers were appointed, three or four for each parish, from amongst the householders, by the justices, and they had to act in conjunction with the churchwardens. The churchwardens and overseers were also empowered to build poorhouses at the expense of the parish for the reception of the impotent poor. This act of Elizabeth, which is the basis of the poor-law system of England, came into operation very slowly.

The troubles of 1640, and the civil war that followed them, necessitated an extensive application of the law. In 1662, the second year after the restoration, a law was passed modifying the statute of 1601, so far as the limits of its application was concerned. As before, each parish formed a single district, but as the parishes differed so greatly in extent, the justices of the peace were authorized to appoint overseers for sections of parishes, as townships, villages, and hamlets. By an act passed in 1723 the churchwardens and overseers were empowered to accommodate all their poor in a workhouse, which might be established for a single parish or for several in combination, and all who refused relief given in this way might be struck off the poor's-roll. The maintenance of the poor in these houses was let out by contract to persons who derived what advantage they could from the labour of those able to work. In 1782 an act was passed authorizing the voluntary union of several adjacent parishes to found and support a workhouse for the reception of those poor who required permanent succour, and their control was intrusted to *guardians* appointed for that purpose, as well as for the administration of out-door relief. The working of these laws was attended with numerous abuses, the worst being that by which able-bodied labourers received relief in aid of wages, an allowance being granted out of the parish fund to every labourer who applied for relief in proportion to the number of his family. The poor-rate pressed so heavily, and the execution of the laws regarding it had caused so much inconvenience, that in some parishes tillage had to be abandoned, and the neighbouring parishes were, in consequence, charged with the maintenance of the poor of these, in addition to their own. This state of matters threatened an alarming increase of pauperism. For the year ending with March, 1833, the tax for the relief of the poor was close upon £7,000,000 for a population of less than fourteen millions. A commission was appointed to inquire into these abuses, and the result was the Poor Law Amendment Act of 1834, which forms the foundation of the system in actual operation at the present day.

By it the collection and distribution of the rates were no longer intrusted exclusively to the parish authorities. Each locality was to form an aggregation of a number of parishes called a *union*. Each union was to be under a committee of supervision, composed of guardians named by the ratepayers. This committee was charged with fixing the amount of the contributions, and with ordaining and directing the distribution of relief in the unions, the relief to be dispensed by paid relieving officers appointed by the guardians. The general direction of the whole system was by this act placed in the hands of three commissioners, appointed, paid, and removable by the crown. These were authorized to make rules for the management of the poor, the government of workhouses, the conduct of guardians, vestries, and officers; the keeping of accounts, making of contracts, and all other matters relating to the relief of the poor. One important reform introduced by the law

of 1834 was the refusal of all succour to the able-bodied poor, except in workhouses established on a very rigorous basis, the principle being that no one who obtained parochial relief should be better provided for than the commonest labourer. The effect of the new regulations was immediate, and in three years the expenditure on the poor was reduced by more than £2,000,000. This commission was superseded in 1847 by the Poor-law Board, under 10 and 11 Victoria, cap. cix., and to this new board of commissioners, perpetuated by various subsequent acts, were transferred all the powers and duties of the former commissioners. The Poor-law Board consisted of a president and four commissioners—namely, the lord-president of the council, lord privy-seal, home secretary, and chancellor of the exchequer, and such other as the Queen by letters-patent or commission might appoint. A report of the proceedings of the board was to be submitted to Parliament each year.

The Local Government Board Act of 1871—proceeding on the preamble that it is expedient to concentrate in one department of the government the supervision of the laws relating to the public health, the relief of the poor, and local government—enacted that a board shall be established, to be called the Local Government Board, and from and after the establishment of such board the Poor-law Board shall cease to exist, and all powers and duties, vested in or imposed on the Poor-law Board by the several acts of Parliament relating to the relief of the poor, shall be transferred to, and imposed on, the said Local Government Board, and except as otherwise provided by the act, shall be exercised and performed by such Board in like manner and form, and subject to the same conditions, liabilities, and incidents respectively as such powers and duties might, before the passing of the act, have been exercised and performed by the authorities, in whom the same were then vested respectively, or as near thereto as circumstances admit. The Local Government Board, in terms of this act, shall consist of a president to be appointed by her majesty, and of the following *ex officio* members, namely, the lord-president of the privy-council, all the principal secretaries of state for the time being, the lord privy-seal, and the chancellor of the exchequer. The Parish Councils Act of 1894 has introduced some slight changes in regard to the administration of the poor-law. For instance, the overseers are now appointed by the parish councils instead of by the justices as formerly, and guardians of the poor are not specially elected as such in rural parishes, the parish or district councillors acting as guardians for their parishes. Churchwardens are no longer *ex officio* overseers. The duty of making and levying the poor-rate belongs to the overseers; and the expenditure of the money for behalf of the poor is chiefly controlled by the guardians, who consider whether relief is to be granted in individual cases, order or refuse it, superintend all affairs of their union, settle what money is to be required, decide as to the building of workhouses, personally visit workhouses, and perform many other duties. The poor-rate is levied in advance for a part of the year on a scale adapted to the probable exigencies of the parish; and the act of Elizabeth directs that it should be raised by 'taxation of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, tithes impropriate, appropriations of tithes, coal mines, or saleable underwoods in the parish'. As an occupier a man is ratable for all lands which he occupies in the parish, whether he is resident or not; but the tenant and not the landlord is considered as the occupier within this statute.

After the passing of the act of 1834 unions were

rapidly formed in the southern, eastern, and central parts of England, where the abuses of the previous régime had been most keenly felt; but in the northern and manufacturing districts the measure was very unfavourably received, and led to much disorder. The commissioners, however, notwithstanding these discouragements, continued their work, and now the unions have become universal all over England. The relief afforded to the poor since 1834 is of two kinds, *in-door* and *out-door*, the former given in the workhouse, and the latter in the pauper's own dwelling. Out-door relief is more especially accorded to children, the aged, and invalids, but in certain cases (as of sickness or accident) it is also accorded to the able-bodied. Generally, however, an able-bodied person who receives relief must be living in the workhouse as well as his wife and family, if he has any. With regard to the law of settlement in a parish in reference to parochial relief, see SETTLEMENT. The poor-rate defrays not only the assistance bestowed on paupers, but a certain number of other expenses, as expenses of police, maintenance of roads, &c. The total number of paupers in England and Wales on the 1st of January, 1901, was 801,347; in 1893 in was 783,597, showing an increase of 17,750. The total cost of the poor for the year 1899–1900 was £11,567,649, while the sum raised by poor-rates amounted to £23,046,814.

In the law of Scotland two kinds of poor are recognized, the *idle* and the *infirm*. With regard to the former several acts have been passed for the punishment of sturdy beggars and vagabonds. According to some of these the punishment ordained to be inflicted was of a very severe character, as whipping and burning in the ear; and by Act 1579, cap. lxxiv., a repetition of the crime was made punishable with death. But, except as to some minor penalties kept up against vagabonds, these statutes have fallen into total disuse. With regard to the infirm poor, that is those who from age and other infirmities are unable to maintain themselves, Act 1535, cap. xxii., ordained their maintenance by a tax levied on the parish; and by an Act 1663, cap. xvi., power was given to the landholders in landward parishes to assess themselves for the maintenance of such of the poor as cannot fully maintain themselves, the half of which assessment they were entitled to exact from the tenant. Other acts were subsequently passed for the better administration of previous acts, but up to comparatively recent times the chief source for the relief of the poor consisted in voluntary offerings of the people, collected at the parish churches, and administered by the heritors and kirk-session of the parishes. The act by which the relief of the poor is now chiefly administered, is 8 and 9 Vict. c. lxxxiii. (as modified by subsequent acts). By this act a central board called the Board of Supervision was established to supervise the whole administration of the poor-law in Scotland, and under it there was a parochial board appointed for each parish, the boards being somewhat differently constituted according as they were for a burghal or a non-burghal parish, the electors being owners or occupants assessed, magistrates of burghs, and the kirk-sessions of the parishes. The Board of Supervision consisted of six *ex officio* members, and three others appointed by the crown, one of them being paid and in regular attendance at the offices of the board in Edinburgh. By the Local Government (Scotland) Act, 1894, the Board of Supervision was abolished and a new board, the Local Government Board for Scotland, appointed in its place. The new board consists of the secretary for Scotland as president, the solicitor-general for Scotland, the under-secretary for Scotland, and three salaried members appointed by the crown during pleasure, one of these

being an advocate of seven years' standing, another, a duly qualified medical practitioner. By the same act the parochial boards were abolished, and the new parish councils appointed in their place with all their functions and liabilities. The new act makes no other change in regard to the poor-law. According to the act of 1845 the necessary funds are raised by assessment in each parish, one half being imposed on the owners, and the other half on the occupiers of all lands or heritages within the parish, ratably according to their annual value, that is, the rent that one year with another they might reasonably be expected to let at. The relief is administered to all aged, diseased, and infirm persons unable to gain a livelihood, orphans and destitute children under fourteen years of age, as well as idiots and insane persons, and is accorded to the occasional as well as to the permanent poor. The law differs from that of England inasmuch as able-bodied persons out of employment have no right to demand relief. The relieving officers are the inspectors appointed by the boards. The inspector has to make himself personally acquainted with the circumstances of all the paupers in his parish, visit them officially at least twice a year, report to his own and the chief board matters relating to the poor, take charge of all books and documents relating to the relief of the poor, &c. The parish in which a man has been born is the one which is bound to support him, unless he has formed a new settlement for himself by residence. A residence of five years in any parish continuously, without applying for relief and without begging, constitutes a settlement there. The number of registered paupers and their dependants on the 14th May, 1878, was 94,671—a number lower than that registered in any previous year. In 1880 the number was 98,608; while in 1901 it was 100,819.

In Ireland there were no poor-laws till 1838. By 1 and 2 Vict. cap. lvi. passed in that year, Ireland is divided, for the purposes of poor relief, into 160 unions of town-lands or parishes. Each union has a workhouse, managed by a board of guardians elected by the ratepayers. Every destitute person has an absolute right to relief, which is administered almost entirely in the workhouse. In 1891 the number of paupers was 107,129; in 1901 it was 101,090.

The following is a statement of the total expenditure for the relief of the poor (including cost of management) in England and Wales, Scotland, and Ireland, in five recent years.

	England	Scotland	Ireland.
1881	£8,102,136	£921,449	£1,237,785
1885	8,414,892	871,511	1,259,010
1890	8,434,345	841,952	1,061,244
1893	9,217,514	873,947	1,039,230
1900	11,567,649	1,110,302	1,125,110

In the thirty-two years ending 1901 the number of paupers in England decreased from 1,079,391 to 801,347; those in Scotland decreased more than proportionately; on the other hand, Ireland's pauper roll shows a very considerable increase, namely, from 73,921 to 101,090.

There are special acts of Parliament regulating the removal of paupers from any one of the three divisions of the United Kingdom—England, Scotland, and Ireland—to any other of these. (See REMOVAL OF THE POOR.)

POOR'S RATE is the name given in Britain to the taxes raised for the aid of those who cannot support themselves. See POOR AND POOR'S LAWS.

POOR'S ROLL, in the law of Scotland, is the list of litigants who, by reason of poverty, have the privilege of suing or defending a case in court *in forma pauperis*, by which they are exempted from the payment of any court fees, and are entitled to have their

case conducted gratuitously by the counsel and agents for the poor. The privilege of poor's roll is only accorded to an applicant on his producing a certificate signed by the minister and two elders of the parish in which he resides, setting forth his circumstances, according to a formula annexed to the act. If this certificate is found correct and the petition is received by the court it is remitted to the counsel for the poor, to report whether the petitioner has a *probabilis causa litigandi*, that is, a good cause of action. If their report be favourable the case is then remitted by the court to the counsel and agent who have thus reported, to be conducted by them.

POPAYAN, a city of Colombia, in a fertile plain watered by the Cauca, and near the volcanoes Puracé and Sotaro, 228 miles south-west of Bogota. It is the seat of a bishopric, has a university, a college, an hospital, and other public institutions. It was founded in 1536, and almost completely destroyed by an earthquake in 1834. Pop. about 8500, though at one time above 20,000.

POPE, ALEXANDER, a celebrated English poet, was born May 21, 1688, in Lombard Street, London, where his father, a linen-draper, acquired a considerable fortune. Both his parents were Roman Catholics. Soon after the birth of his son, who was of very delicate constitution, small, and much deformed, the father of Pope retired from business to a small house at Binfield, near Windsor Forest. The young poet was taught to read and write at home, and at the age of eight was placed under the care of a Catholic priest, named Taverner, from whom he learned the rudiments of Latin and Greek. Being fond of reading he became acquainted at this early period with Ogilby's version of Homer, and Sandys' translation of Ovid's *Metamorphoses*, which books first turned his attention to poetry. He was successively placed at two other schools, the first at Twyford and the second at Hyde Park Corner, where he formed a play taken from Ogilby's Homer, intermixed with verses of his own, and had it acted by his school-fellows. About his twelfth year he was taken home and privately instructed by another priest; and to this period is assigned his earliest printed poem, the *Ode on Solitude*. He subsequently appears to have been the director of his own studies, in which the cultivation of poetry occupied his chief attention. He particularly exercised himself in imitation and translation, of which his versions of the first book of the *Thebais* and of the *Sappho to Phaon*, made at the age of fourteen, afford a remarkable testimony. He was sixteen when he wrote his *Pastorals*, which procured him the notice of several eminent persons. His *Ode for St. Cecilia's Day* and *Essay on Criticism* were his next performances of note, the latter of which was written in 1709, and published in 1711. He became embroiled with Ambrose Philips in consequence of an ironical comparison of that writer's pastorals with his own in the *Guardian*, and with the irascible critic John Dennis, owing to a humorous allusion to him under the name of Appius, in the *Essay on Criticism*. The *Elegy on an Unfortunate Lady*, which appeared in 1711, was followed by the *Rape of the Lock*, grounded on a trifling incident in fashionable life. In this production the poet displays admirable vivacity and the most polished wit, but its imaginative power is chiefly conspicuous in the exquisite machinery of the sylphs, wrought into it as an afterthought, for the poem first appeared without it. He next published the *Temple of Fame*, altered and modernized from Chaucer, which was followed in 1718 by his *Windsor Forest*, commenced at sixteen. In the same year he published proposals for a translation of the *Iliad*, by subscription, which were received with great encouragement; and the first

volume, containing four books, appeared in 1715 (in 4to). An open breach with Addison preceded this publication, owing to an alleged jealousy on the part of the latter, to whom a rival translation of Homer, published under the name of Tickell, was attributed by Pope. Whether by Addison or Tickell, the rival version soon sank before that of Pope, who was enabled by the great success of his undertaking to take a handsome house at Twickenham, to which he removed with his mother in 1719. Previous to this time he wrote his impassioned *Epistle from Elvira to Abelard*, one of the most vivid and impressive of all amatory poems. In 1717 he republished his poetry in a quarto volume, to which he prefixed an elegant preface, and in 1720 completed the *Iliad*. In 1721 he undertook the editorship of Shakspeare's works—a task for which he was wholly unfit; and a severe castigation from Theobald laid the foundation of a lasting enmity between them. With the assistance of Broome and Fenton he also accomplished a translation of the *Odyssey*, the subscription to which brought him a considerable sum. In the meantime he had formed a friendship with Martha Blount, the daughter of a Catholic gentleman near Reading, who became his intimate *confidante* and companion through life. A sort of literary flirtation also commenced with the celebrated Lady Mary Wortley Montagu, which, after much intercourse and correspondence, terminated (see MONTAGU—LADY MARY WORTLEY) in the bitterest enmity. In 1727 he joined Swift in a publication of *Miscellanies*, in which he inserted a treatise *Of the Bathos, or Art of Sinking*, illustrated by examples from the inferior poets of the day. In 1728 he sent out the three first books of his *Dunciad*, a mock-heroic poem, the object of which was to overwhelm his antagonists with ridicule. It is a finished example of diction and versification, but displays much irritability, illiberality, and injustice. Personal satire, to which he was first encouraged by Bishop Atterbury, appears in most of his subsequent productions. Being particularly connected with the Tory party he had become intimate with Lord Bolingbroke, to whose suggestion the world is indebted for the *Essay on Man*, first published anonymously in 1733, and the next year completed and avowed by the author. This work is more distinguished by its poetry than its ethics. It was followed by *Imitations of Horace*, accompanied by a *Prologue* and *Epilogue* to the *Satires*, and by *Moral Epistles or Essays*, which exhibit him as a satirist of the school of Boileau, with more spirit and poetry and equal causticity. The persons whom in these works he treats with most severity are Lady Mary W. Montagu and Lord Hervey. Curll, the bookseller, having published some letters written by Pope, the latter affected great anger; yet there is some evidence to countenance the notion that he contrived the plot himself, in order to form an excuse for the publication of a quarto volume of letters, in his own name, for which he took subscriptions. They are elegant and sprightly, although studied and artificial; but as many characteristic epistles are given from those of his correspondents, the collection is interesting and valuable. In 1742, at the suggestion of Warburton he added a fourth book to his *Dunciad*, intended to ridicule useless and frivolous studies, in which he attacked Colley Cibber, then poet-laureate. Cibber retaliated by a pamphlet, which told some ludicrous stories of his antagonist, and so irritated the latter that, in a new edition of the *Dunciad*, he deposed Theobald, its original hero, and promoted Cibber in his place, who, although a great coxcomb, could scarcely be deemed a dunce.—An oppressive asthma began now to indicate a commencing decline, and in this state of debility he was consoled by the affectionate attention of his friends,

and particularly of Lord Bolingbroke. When the last scene was approaching he allowed one of his intimates, the historian Hooke, himself a Catholic, to send for a priest, not as essential, but becoming; and soon after quietly expired, May 30, 1744, at the age of fifty-six. He was interred at Twickenham, where a monument was erected to him by Bishop Warburton, his legate.

Both the moral and poetical character of Pope have been assailed and defended with peculiar animation. Vain and irascible he seems to have been equally open to flattery and prone to resentment; but one of his greatest weaknesses was a disposition to artifice in order to acquire reputation and applause, which is justly deemed indicative of littleness of mind. He was not, however, incapable of generous and elevated sentiments, and was as firm in his attachments as implacable in his dislikes. He had always a dignified regard to his independence, which in one to whom money, high connections, and the superfluities of life, more especially the luxuries of the table, were by no means indifferent, is the more remarkable. He has been accused of meanness towards his literary coadjutors, but certain stories of a nature to impeach his integrity are now no longer believed, especially as something like an indisposition to do him justice, either as a poet or a man, has been manifest in those who related them. As a poet, while his claim to invention is bounded, the endeavour to set him aside altogether, in compliment to certain metaphysical distinctions in regard to the primary sources of poetic feeling, is factitious and futile. No English writer has carried further correctness of versification, splendour of diction, and the truly poetical art of vivifying and adorning every subject that he touched. His *Rape of the Lock*, and *Epistle from Eloisa to Abelard*, are alone sufficient to impeach the exclusive theory which would deny him the rank and powers of a poet, leaving his wit, his brilliancy, and his satire to be ranked as they may be. Of the various editions of Pope's works it is only necessary to mention those of Warburton, Johnson, Warton, and Bowles (the last in ten vols. 8vo 1806), and especially the great edition in ten vols. (one containing life) by the Rev. W. Elwin and W. J. Courthope, giving about 300 letters previously unpublished.

POPES. *Pope* (Greek, *pappas*, father) is the title given to the head of the Roman Catholic hierarchy; it is also applied by the eastern Christians to all priests, and in early times was given in the West to all bishop, until subsequently it was restricted to the Bishop of Rome. During the apostolic age, and for more than a century afterwards, the Christian churches were in entire independence, so far as their government was concerned, of each other. Each church had its presbyters or bishops—for these were convertible terms—and its deacons, and upon these functionaries devolved the spiritual charge of the congregation. But gradually this state of matters changed, and gave place to the episcopal form of government. One of their number was elected to preside over the college of presbyters, and to him was given the special title of bishop. Though at first regarded only as first among his equals, the bishop soon claimed authority over his co-presbyters. The custom of holding provincial synods began to prevail towards the end of the second century. These assemblies consisted of the bishops of the independent churches, with a few presbyters and deacons. 'A regular correspondence,' says Gibbon, 'was established between the provincial councils, which mutually communicated and approved their respective proceedings; and the Catholic Church soon assumed the form and acquired the strength of a great federative republic.' The bishops of the third century imperceptibly substituted for the lan-

guage of exhortation that of command. They were the vicegerents of Christ, the successors of the apostles, and the mystic substitutes of the high-priest of the Mosaic law. As formerly among the presbyters, so now among the bishops, some acquired pre-eminence over the others. The pre-eminence in councils was accorded to the metropolitans, or the bishops of the chief cities of the provinces, and next arose a struggle amongst the metropolitans themselves for the pre-eminence. From various causes, but more especially from the circumstance that Rome was the ancient capital of the empire, and, according to tradition, the scene of the latest labours of St. Peter, it was easy to foresee that the bishop of that city, the alleged successor of Peter, would obtain the respect, and soon claim the obedience, of the provinces. To Rome disputants appealed for ultimate decision, and oppressed parties for advocacy and protection. Thus Rome gradually rose in authority, and soon claimed, as of right, what at first personal confidence or the urgency of circumstances had accorded in special and individual instances. From the end of the fourth century the Bishop of Rome was the first among the five patriarchs, or superior bishops of Christendom; but he did not at first possess any peculiar jurisdiction over provincial dioceses. A provincial synod at Sardica in Illyria in the year 347, and a decree of the Emperor Valentinian III. in 445, had indeed acknowledged the Bishop of Rome as primate, and as the last tribunal of appeal from the other bishops; but even in the West, where alone these edicts had the force of law, the measures of the popes, until the eighth century, often met with violent opposition. At first the claim to the primacy on the part of the Roman see was based only on human authority. Leo the Great (440–461) was the first, in his instructions to his legates at the Council of Ephesus, held in 449, to rest it on divine authority, by appealing to Matt. xvi. 18: 'Thou art Peter, and upon this rock will I build my church;' which had formerly been interpreted, following Cyprian, as applying to all the apostles, and hence to all bishops. The Eastern Church always resisted the claims of the see of Rome to the primacy, and this it was which mainly occasioned the schism that in 1054 divided Christendom into the Greek and Roman Churches. After the eighth century several circumstances contributed to open to the popes the way to supreme control over all churches. Among these were the establishing of new churches in Germany, which, like those of Britain at an earlier period, being founded by their missionaries, were at first subject to their power; the political confusion, and the change of government in Italy and France; the pseudo-Isidorian decretals, forged between 830 and 850 (which, in those times of ignorance, contributed much to support the claims of the Roman Church to exercise supreme power, by pretended letters and statutes of former bishops of Rome, dated back to the first centuries); the schism between the Eastern and Western Churches, which bound the latter still more closely to the popes as their leaders; the gradations of ecclesiastical rank (see **HIERARCHY**) everywhere introduced by the ambition of the popes, all derived and gradually descending from them, who had assumed the highest place; and, finally, the personal superiority of some popes over their contemporaries. Thus, Leo the Great in the fifth century; Gregory I., called the Great, a zealous, good, and able man, in the sixth century; and Leo III., who crowned Charlemagne, in the eighth century, had obtained for the Papal title an authority which the patriarchs of the East could not attain, and against which the power of princes availed little. There were, indeed, unworthy popes during the middle ages; but after the brilliant

victory which Nicholas I. (who was first solemnly crowned) obtained over Lothaire, king of Lorraine, in the affair of a divorce in 865, and over the Bishops of Trèves and Cologne, whom he deposed by his Papal authority; and after the example which John VIII. had given in 875, of a disposal of the imperial crown, which he conferred on Charles the Bald, the power of the popes could receive but little injury from the violence and corruption which prevailed in the Papal see for more than a hundred years. This corrupt state, due at first mainly to the influence of the Tuscan counts at Rome under Sergius III., early in the tenth century, was continued by the wicked and licentious favourites and relations of the infamous Princesses Theodora and Marozia (one of whom, John XII., in 956, while but eighteen years old, and another, Benedict IX., in 1033, a boy of twelve years, obtained the dignity of pope). Even the scandalous circumstance that in 1045 three popes, chosen by means of bribery, were living together in Rome did not affect the authority of the Papal see. The rudeness of the age concealed the scandal of such things. In the midst of all this darkness a ray of light appears in the reign of the excellent Sylvester II. (999-1003), who was one of the most learned men of his time, and whom the world regarded as a magician. The troubles arising during the decline of the Carolingian dynasty in France and Germany offered an extensive and continually enlarging field of action to the ambition of the popes; and their dignity and independence of the nobles and people of Rome, which they had often lost during the contentions of factions, were regained by them by the constitution of Nicholas II., in 1059, placing the right of election to the Papal chair in the hands of the cardinals (see CONCLAVE), to the exclusion of the laity. After this a succession of good rulers, of great talents and excellent character, sat upon what was then the first throne in Christendom:—Gregory VII. (1073-85), who surpassed them all in spirit and in power, and who began to carry through with wonderful perseverance the project of universal dominion; Urban II., who was several times driven from Rome by the anti-pope Clement III., but who from 1088 to 1099 ruled with extensive influence and extraordinary vigour; Alexander III. (1159-81), who during his reign survived two rivals, and overcame a third, who brought the Kings of England and Scotland to unconditional obedience in religious matters, who made the Emperor Frederick I. hold his stirrup, and confirmed the system of the election of popes; and Innocent III. (1198-1216), whose reign raised the Papal see to the highest degree of power and dignity.

What the popes in earlier times had only attempted in peculiar circumstances, these great men, so superior to their age, made the settled usage by a regular series of bold measures and persevering efforts. They united the clergy of Western and Central Europe closely to the Papal see by the introduction of a new form of oath, by the law of celibacy, and by the law of investiture, which broke the union of bishops with their temporal princes, and under Innocent III. was extended to a power of disposing at pleasure of all the dignities and benefices of the church. By means of their legates and nuncios they obtained the bishop's right of deciding in ecclesiastical and matrimonial affairs, and the exclusive right of canonization; and they thus made the popes the sole fountain of ecclesiastical dignity and power in western christendom. By eventually assuming the old right of convening councils and national synods whose decrees became valid only by being ratified by the pope, and by maintaining with more and more boldness their claims to infallibility, they at length obtained complete dominion over the church. & the orders of monks, especially of the mendicant

orders, they created a spiritual army, who, having in their hands the Inquisition, the right of hearing confessions, and of preaching, together with the public superintendence of schools and universities, became the most useful instrument of their policy, and one of the strongest supports of their power. The success of these advances towards unlimited spiritual dominion gave them courage to strive also after temporal power.

But the claims of the popes to worldly dominion are of much later origin than the historians of the court of Rome have maintained. Constantine the Great gave them merely some buildings and estates in and near Rome. By the gift of Pepin (see CHURCH—STATES OF THE) the pope obtained merely the *dominium utile*, that is, the use of lands intrusted to him. In this way he became in a manner a vassal of the Frankish kings, and afterwards of the German emperors, who exercised without opposition the right of sovereignty over the Papal dominions, and until the twelfth century suffered no election of pope to take place without their ratification. Innocent III. first established the rule that Rome, the Marches, and the hereditary possessions of Matilda (see MANTUA) should do him homage as lord paramount, in 1198, and thus vanished the last shadow of the power of the emperors over Rome and the pope. Favourable circumstances had already made several kingdoms tributary to the Papal see. England was thus situated from the time of its conversion to Christianity, so were Poland and Hungary, from the eleventh century; Bulgaria and Arragon, from the beginning of the thirteenth; and the Kingdom of the Two Sicilies (whose Norman kings had been vassals of the pope), from 1265, when Clement IV. gave it to the house of Anjou through hatred towards the house of Hohenstaufen. Even the East would have fallen under the power of Rome if the success of the Crusades (which had given rise in the West to much confusion in regard to the rights of citizens and private property, and thereby promoted the influence of the pope) had been less transitory. Innocent III. dared to depose and proclaim kings, as, for instance, John of England, and to threaten the whole world with excommunication. The Emperor Otho IV. called himself such by the grace of God and of the pope. Kings were called *sons of the pope*; and the fear of the terrible consequences of the interdict which they pronounced as vicars of Christ upon disobedient princes and their kingdoms, the rebellious spirit of the barons, the ill-regulated constitution of states, and the great want of laws, subjected the rulers of those times to the authority of a lord whose court was the cradle of modern politics, and whose power and influence were irresistible, because supported by public opinion and by superstition. It was with reason, then, that the papacy at that time was called a *universal monarchy*. This priestly government, however, did good by accustoming the rude princes and people to laws and Christian manners; and at a time when rights were first beginning to be understood, its inconsistency with true independence was not felt.

France alone, which had acquired more consistency and power than the other monarchies of Europe by the subjugation of the great vassals and the reduction of their territories under the royal government, first successfully resisted the popes. In Philip the Fair Boniface VIII., one of the boldest and most able popes, found a master, and his successors, during their residence at Avignon between 1307 and 1377, remained under French influence. The independence of the popes visibly suffered from the circumstance that they were now bound to a particular political party, though they continued to exercise over all the Christian countries of the West the power which

their arts and perseverance had obtained. Their dignity sunk still lower when, in 1378, two rival popes appeared—the Italian Urban VI., and a count of Geneva, chosen by the French cardinals, who took the name of Clement VII. Europe was divided by their quarrel, the Italian being supported by Italy, Germany, England, and the northern kingdoms; the French pope by France, Spain, Savoy, Lorraine, and Scotland; and the schism long remained. The public sale of offices, the shameful extortions, and the low artifices which most of these rival popes used against each other, gave rise in England and Bohemia (see Huss) to much complaint, and to demands for a reform in the state of the church. The council of Constance had, indeed, succeeded in putting an end to the great schism by deposing both of the rivals; but Pope Martin V., who was chosen in 1417 in their place, did not correct the abuses which had grown up under his predecessors, and even the most express decrees for reform, passed by the Council of Basel, were rendered nugatory by the artifices and the perseverance of Eugene IV., who was pope between 1431 and 1477. He had gained the friendship of France in 1438 by the Pragmatic Sanction, which laid the foundation of the freedom of the Gallican Church; and the negotiations of *Aeneas Sylvius*, ambassador of Frederick III., with him and his successor, the excellent Nicholas V., a friend to ancient literature, and the protector of the learned exiles from Greece, effected the Concordat of Vienna in 1448. Why the grievances of the German nation were so little remedied by this instrument, while the interest of the pope was carefully attended to, the German princes, whom the eloquence of the cunning negotiator *Aeneas Sylvius* had induced to accept it, first perceived when he was chosen cardinal, and in 1458 pope, under the name of Pius II. In this Concordat the popes obtained the confirmation of the annates, of the right of ratifying the election of prelates, and many other privileges.

In care for his family no pope ever surpassed Alexander VI. (1492–1503), whose training and qualifications fitted him for a temporal rather than a spiritual ruler. His successor Julius II. (1503–18), employed all his powers in politics, and in a war with France, in which he commanded his own army, but was obliged to flee before Bayard. Fortunately for him and for his successor, Leo X., Maximilian I. was prevented by circumstances, and finally by death, from uniting upon his own head the Papal and imperial crowns. The circumstance that Austria, France, and Spain were fighting for Lombardy and Naples, and therefore sought alternately the favour of the pope, had caused the latter to rise anew in political importance towards the end of the fifteenth century; but the spirit of the times was acquiring an irresistible strength, and the policy of Leo X. was of no avail against it. Luther, Zuinglius, and Calvin were the heralds of an opposition which tore almost half of the West from the popes, while the policy of Charles V. was at the same time diminishing their power. What the ages of ignorance had allowed to the pope the Council of Trent indeed now ratified; and the Society of the Jesuits came forward as the guards of his throne, striving to erase all traces of the Reformation in the states which had remained Catholic, and to regain by missions among the heathen what had been lost in Europe; yet neither this new support, nor the policy of artful popes such as Clement VII. (1523–84), whom Charles of Bourbon, the general of the emperor, drove in 1527 into the castle of St. Angelo; and Paul III. (1534–49), who gained for his family Parma and Piacenza; nor the monkish devotion of Paul IV. (1555–59); nor the moderation of Pius IV. (1559–65), who condescended to grant the cup to the Bohemian Hussites;

nor the severity of Pius V. (1566–72), who offended both princes and people by his bull *In oena Domini*, worthy of his previous character as a proud Dominican and furious persecutor of heretics, although his severe austerity obtained him the honour of canonization; still less the useful activity of Gregory XIII. (1572–85), who gave to the world the amended calendar (Gregorian); the magnanimity and wisdom of Sixtus V. (1585–90); the good fortune of Clement VIII. (Aldobrandini, 1592–1605), who in 1598 added Ferrara to the States of the Church; the learning of Urban VIII. (1623–44), who added Urbino to his dominions, and obliged Galileo to abjure his doctrine of the motion of the earth round the sun,—could restore the old authority of the Papal throne. In vain did the court of Rome employ the language of Gregory VII. and Innocent III.; even in Catholic states the distinction between ecclesiastical and political affairs had been perceived so clearly that the influence of the popes upon the latter was now very limited.

Since the middle of the sixteenth century no German emperor had been crowned by a pope. The princes who had learned his policy withdrew themselves from his authority. The national churches obtained their freedom in spite of all opposition, and the Peace of Westphalia, which the Papal see never acknowledged, gave public legality, guaranteed by all the powers of Europe, to a system of toleration which was in direct contradiction to the papal doctrines. Under such circumstances the question no longer was how to extend the papal authority, but how to prevent its utter destruction; and the vicar of Christ, who, when he began to call himself servant of servants, was lord of lords, was obliged to play the part of a suppliant, who claims compassion and toleration rather than obedience. Jansenism also took from the popes a considerable part of the Netherlands; their bulls were no longer of avail beyond the states of the Church without the consent of the sovereigns, and the revenues from foreign kingdoms grew smaller and smaller. In France, and soon after in Germany, they became the objects of ridicule; and the excellent men who occupied the pontifical chair in the eighteenth century, the learned Lambertini (1740–58) (see BENEDICT XIV.), and the enlightened Ganganelli (Clement XIV., 1769–74), were forced to expiate the guilt of their predecessors, and sought to obtain, by means of patience, condescension, and personal merit, the esteem and influence which the others had haughtily claimed.

Still greater misfortunes fell upon their successors, Pius VI. (1775–98) and Pius VII. (1800–23). The first, after a bitter experience of the progress of knowledge, just when the death of Joseph II. had inspired him with new hopes, was witness of the revolution which tore from him the French Church, and deprived him of his dominions. The other was forced to buy his personal freedom, and the possession of his diminished states, by an equivocal concordat with Bonaparte in 1801, and by much personal humiliation, and lost them both again in 1809. He owed his restoration in 1814, not to the excommunication which he had pronounced against Napoleon, but to a coalition of temporal princes, among whom were two heretics (the English and Prussian) and a schismatic (the Russian). Nevertheless, he not only restored the Inquisition, the order of the Jesuits, and other religious orders, but advanced claims and principles entirely opposed to the ideas and resolutions of his liberators. He openly declared against the toleration of the philosophic sects, against Bible societies, and translations of the Bible. (See Pius VII.) In the meantime there appeared in the French and German Catholic churches a spirit of freedom, and an increasing wish for an independent national

church. The same spirit that actuated Pius VII. actuated, in like manner, his successors, Leo XII. (1823-29), Pius VIII. (1829-30), and, above all, Gregory XVI. (1831-46). The rigour with which the last-mentioned pope opposed and suppressed every reform in the civil relations of the Papal dominions, which the spirit of the time dictated, contributed greatly to the outbreak of the revolution of 1848, which obliged his successor Pius IX. to flee from Rome, and prepared the way for the establishment of a Roman republic. It was only by means of the aid afforded by Austria and France that the temporal power of the Papacy was not entirely swept away. This power was further weakened by the events of 1859 and 1860, which resulted in all the States of the Church being seized upon by the Sardinian troops, with the exception of Rome, Civita Vecchia, and certain districts that were occupied by the French army. Hostilities again broke out in 1866, when Garibaldi entered the Papal territory and defeated the pontifical troops at Monte Rotondo (October 26), though a few days later he himself was in turn completely vanquished by the united pontifical and French armies. After the withdrawal of the French troops from Italy in 1870, King Victor Emmanuel took possession of Rome, and since that time the pope has lived in seclusion in the Vatican.

Previous to the Vatican Council, which assembled in 1870, Papal infallibility was the subject of much controversy, but that council settled the matter definitely in declaring the pope to be infallible. According to the decrees of this council the pope has not only the office of inspection and direction, but also the whole fulness of supreme power in discipline as well as of faith, and this power is ordinary and immediate over all and each of the pastors and of the faithful. The pope may on sufficient grounds withdraw jurisdiction from a particular bishop, but cannot destroy the episcopacy. In virtue of his office he has direct power over each Catholic in any particular diocese; the bishop of such diocese, though still having the same power pertaining to his office, must exercise it in union with and subordination to the pope. It is further taught by the Vatican Council that when the pontiff speaks *ex cathedra*—that is, when he, using his office as pastor and doctor of all Christians in virtue of his apostolic office, defines a doctrine of faith and morals to be held by the whole church, he, by the divine assistance promised to him as the successor of St. Peter, possesses that infallibility with which Christ was pleased to invest his church in the definition of the doctrine on faith and morals, and that, therefore, such definitions of the pope are irreformable in their own nature, and not because of the consent of the church. The pope in himself is liable like other men to error; his infallibility comes from the Holy Spirit, which on certain occasions protects him from error in faith and morals. He has no infallibility in merely historical or scientific questions. In matters of faith and morals even he has no inspiration, and must employ the same means of theological research as other men. He may even err as a private doctor; nor is any immunity from error accorded to books he may write and publish. Even when he speaks with apostolic authority he may err, the theory of the Vatican Council being that God protects him from error in definitions on faith and morals when he imposes belief on the Universal Church. Extensive as the power and functions of the pope may thus appear to be, it would be an error to suppose that he was an absolute monarch. He cannot annul the constitution of the church as ordained by Christ, his power of definition is circumscribed by numerous definitions originating from his predecessors, previous councils, &c. If he

obstinately rejected an article of faith which has already been proposed by the church, and to which he himself owes allegiance equally with the simplest of the faithful, he might be judged and replaced.

The pope may condemn or prohibit books; may reserve to himself the canonization of saints; and may alter the rites of the church in matters which are not essential. Frequently on such occasions, though exercising his supreme authority, he does not speak *ex cathedra* or claim infallibility. To the pope belongs the supreme direction of discipline; he may enact laws for the whole church; he can inflict censures such as excommunication on all Christians, and reserve to himself the prerogative of absolution from certain sins. He alone can erect, suppress, or divide dioceses, translate or deprive bishops, and that without crime on their part, should the general good of the church demand it; and he alone, also, can approve new religious orders, and exempt them if he deems it expedient from episcopal jurisdiction. A pope has no power to nominate his successor, election (which at first was in the hands of the whole Roman community, but subsequently was greatly controlled by the rulers of Italy, France, Germany, and Spain) being now entirely in the hands of the cardinals. (See CONCLAVE.) The cardinals are not bound to choose one of their own body; a layman and even a married man may be lawfully elected.

We subjoin a table of the popes, according to the Roman Notizie, with the dates of the commencement of their pontificates. The names printed in italics are those of anti-popes:—

St. Peter	A.D. 42	St. Gelasius I.	A.D. 492
St. Linus	66	St. Anastasius II.	496
St. Anacletus	78	St. Symmachus	498
St. Clement I.	91	St. Hormisdas— <i>Lawrence</i>	514
St. Evaristus	100	St. John I.	523
St. Alexander I.	108	St. Felix IV.	526
St. Sixtus I.	119	Boniface II.— <i>Dioscorus</i> ..	530
St. Telesphorus	127	John II.	533
St. Hyginus	139	St. Agapetus I.	535
St. Pius I.	142	St. Sylvester	536
St. Anicetus	157	Vigilius	537
St. Soteris	168	Pelagius I.	555
St. Eleutherius	177	John III.	560
St. Victor I.	193	Benedict (I.) Bonosus ..	574
St. Zephyrinus	202	Pelagius II.	578
St. Callixtus I.	217	St. Gregory I the Great	590
St. Urban I.	223	Sabinianus	604
St. Pontianus	230	Boniface III.	607
St. Anterus	235	St. Boniface IV.	608
St. Fabian	236	St. Deusedit	615
St. Cornelius	250	Boniface V.	619
St. Lucius I.— <i>Novati-</i>		Honorius I.	625
<i>anus</i>	252	(See vacant 1 year and	
St. Stephen I.	253	7 months.)	
St. Sixtus II.	257	Severinus	640
St. Dionysius	259	John IV.	640
St. Felix I.	269	Theodorus I.	642
St. Eutychianus	275	St. Martin I.	649
St. Caeus	283	St. Eugenius I.	654
St. Marcellinus	296	St. Vitalianus	657
(See vacant 3 years and		Adeotatus	672
6 months.)		Donus or Domnus I.	676
St. Marcellus I.	808	St. Agathon	678
St. Eusebius	810	St. Leo II.	682
St. Melchades or Mil-		St. Benedict II.	684
tiades	811	John V.	685
St. Sylvester I.	814	Conon— <i>Theodorus; Pas-</i>	
St. Marcus	836	<i>chal</i>	686
St. Julius I.	837	St. Sergius I.	687
Libertus	852	John VI.	701
St. Felix II. (sometimes		John VII.	705
reckoned an Antipope)	355	Nisinnus	708
St. Damasus I.	366	Constantine	708
St. Siricius	384	St. Gregory II.	715
St. Anastasius I.	396	St. Gregory III.	731
St. Innocent I.	402	St. Zachary	741
St. Zosimus	417	Stephen II. (died before	
St. Boniface I.— <i>Bvalius</i>	418	consecration)	752
St. Celestine I.	422	Stephen III.	752
St. Sixtus III.	432	St. Paul I.— <i>Constantine;</i>	
St. Leo I. the Great ..	440	<i>Theophylactus; Philp</i>	757
St. Hilary	461	Stephen IV.	768
St. Simplicius	468	Adrian I.	772
St. Felix III.	468	St. Leo III.	796

Stephen V.....A.D.	816
St. Paschal I.....	817
Eugenius II.....	824
Valentinus.....	827
Gregory IV.....	827
Bertrius II.....	844
St. Leo IV.....	847
Benedict III.—Anastasius	855
St. Nicholas I.....	858
Adrian II.....	867
John VIII.....	872
Martinus II., or Martin II.	882
Adrian III.....	884
Stephen VI.....	885
Formosus.....	891
Boniface VI. (reigned only	
18 days, and not in-	
cluded among the popes	
by Baronius and others)	896
Stephen VII.....	896
Romanus.....	897
Theodorus II.—Sergius	
III.....	898
John IX.....	898
Benedict IV.....	900
Leo V.....	908
Christopher.....	908
Bertrius III.....	904
Anastasius III.....	911
Lando.....	918
John X.....	914
Leo VI.....	928
Stephen VIII.....	929
John XI.....	931
Leo VII.....	936
Stephen IX.....	939
Martinus II., or Martin III.	943
Agapetus II.....	946
John XII.—Leo VIII.....	956
Benedict V.....	964
John XIII.....	965
Benedict VI.....	972
Donus or Domnus II.....	974
Benedict VII.....	975
John XIV.—Boniface VII.	983
John XV.....	985
Gregory V.—John XVI.....	996
Sylvester II.....	999
John XVI. or XVII.....	1003
John XVII. or XVIII.....	1008
Sergius IV.....	1009
Benedict VIII.—Gregory	
VI.....	1012
John XVIII. or XIX.....	1024
Benedict IX (deposed)—	
John XX.....	1038
Gregory VI.—Sylves-	
ter II.....	1045
Clement II.....	1046
Damasus II.—Benedict	
IX. attempts to resume	
the throne.....	1048
St. Leo IX.....	1049
Victor II.....	1055
Stephen X.....	1057
Benedict X.....	1058
Nicholas II.....	1058
Alexander II.—Hono-	
rius II.....	1061
Gregory VII. (Hildebrand)	
—Clement III.....	1078
(See vacant 1 year.)	
Victor III.....	1086
Urban II.....	1088
Paschal II.....	1099
Gelasius II.—Gregory	
VIII.....	1118
Callixtus II.....	1119
Honorius II.—Celestine II.	1124
Innocent II.—Anacletus	
II.—Victor IV.....	1130
Celestine II.....	1143
Lucius II.....	1144
Eugenius III.....	1145
Anastasius IV.....	1153
Adrian IV. (Nicholas	
Breakspear, an Eng-	
lishman).....	1154
Alexander III.—Victor	
V.; Paschal III.; Callis-	
tus III.; Innocent III.	1159
Lucius III.....	1181
Urban III.....	1185
Gregory VIII.....	1187
Clement III.....	1187
Celestine III.....	1191

Innocent III.....A.D.	1198
Honorius III.....	1216
Gregory IX.....	1227
Celestine IV.....	1241
(See vacant 1 year and	
7 months.)	
Innocent IV.....	1243
Alexander IV.....	1254
Urban IV.....	1261
Clement IV.....	1265
(See vacant 2 years and	
9 months.)	
Gregory X.....	1271
Innocent V.....	1276
Adrian V.....	1276
John XIX. or XX. or	
XXI.....	1276
Nicholas III.....	1277
Martin IV.....	1281
Honorius IV.....	1285
Nicholas IV.....	1288
(See vacant 2 years and	
3 months.)	
St. Celestine V.....	1294
Boniface VIII.....	1294
Benedict XI.....	1303
Clement V. (papacy re-	
moved to Avignon).....	1305
(See vacant 2 years and	
8 months.)	
John XXII.....	1316
Benedict XII.—Nicholas	
V. at Rome.....	1334
Clement VI.....	1342
Innocent VI.....	1352
Urban V.—Clement VII.	1362
Gregory XII. (throne re-	
stored to Rome).....	1370
Urban VI.....	1378
Boniface IX.—Benedict	
XIII. at Avignon.....	1389
Innocent VII.....	1404
Gregory XIII.....	1408
Alexander V.....	1409
John XXIII.....	1410
Martin V.—Clement VIII.	1417
Eugenius IV.—Felix V.	1431
Nicholas V.....	1447
Callixtus III.....	1455
Pius II.....	1458
Paul II.....	1464
Sixtus IV.....	1471
Innocent VIII.....	1484
Alexander VI.....	1492
Pius III.....	1503
Julius II.....	1503
Leo X.....	1513
Adrian VI.....	1522
Clement VII.....	1523
Paul III.....	1534
Julius III.....	1550
Marcellus II.....	1553
Paul IV.....	1555
Pius IV.....	1559
St. Pius V.....	1566
Gregory XIII.....	1572
Sixtus V.....	1585
Urban VII.....	1590
Gregory XIV.....	1590
Innocent IX.....	1591
Clement VIII.....	1592
Leo XI.....	1605
Paul V.....	1605
Gregory XV.....	1621
Urban VIII.....	1623
Innocent X.....	1644
Alexander VII.....	1655
Clement IX.....	1667
Clement X.....	1670
Innocent XI.....	1676
Alexander VIII.....	1689
Innocent XII.....	1691
Clement XI.....	1700
Innocent XIII.....	1721
Benedict XIII.....	1724
Clement XII.....	1730
Benedict XIV.....	1740
Clement XIII.....	1758
Clement XIV.....	1769
Pius VI.....	1775
Pius VII.....	1800
Leo XII.....	1823
Pius VIII.....	1829
Gregory XVI.....	1831
Pius IX.....	1846
Leo XIII.....	1878

The dates in the above list are not always, particularly in the earlier part, accurately ascertained. The belief that St. Peter was bishop of Rome is supported by no satisfactory documentary evidence, though to Roman Catholics the tradition in its favour is sufficiently strong to make it an article of faith. The silence of the epistle to the Romans, which was written about 58, will seem to many sufficient to prove the groundlessness of this belief. Linus is supposed by some writers to have been the vicegerent of Peter as well as his successor.

POPISH PLOT, an imaginary conspiracy which Titus Oates (which see) pretended to have discovered in 1678, and by which he succeeded in deluding the mind of the nation over a space of two years, and causing the death of many innocent Catholics. The delusion, moreover, was fostered by some political leaders, with a view to promoting their own party schemes, and there is no doubt that not a few circumstances of the time tended to countenance the delusion. The Roman Catholics were particularly busy with their machinations at the time, and were not without hopes of seeing Catholicism reinstated as the ruling power in England. The plot, it was alleged by Oates, was formed by the Jesuits and Roman Catholics for the purpose of murdering the king (Charles II.), and subverting the Protestant religion. After some preliminary steps Oates went to Sir Edmund Berry Godfrey, a justice of peace, and gave evidence before him of all the articles of the pretended conspiracy. Among the persons accused was Coleman, secretary to the Duchess of York, among whose papers was found a correspondence with some Catholics abroad, which contained expressions of great violence and indiscretion, but little to countenance the notion of such a plot. In the midst of the alarm created by this pretended revelation Godfrey was found dead in a ditch (October 17), and the cry was immediately raised that he had been murdered by the Papists on account of his taking Oates's evidence, though nothing transpired that could substantiate that view. Parliament met soon after this event, and the two Houses immediately began to occupy themselves with examinations in regard to the plot. Before a week had elapsed a Bill was passed by the Commons to exclude the Catholics from both Houses. The Commons likewise passed a resolution, which was afterwards ratified by the Lords, to the effect 'that there had been and still was a damnable and hellish plot, contrived and carried on by the Papist recusants, for assassinating the king, subverting the government, and rooting out the Protestant religion.' The encouragement held out to Oates, who received a pension of £1200, brought forward Bedloe, a noted thief and impostor, who confirmed Oates's statements, with some additions of his own. He accused several noblemen by name of a design to raise forces in different parts of the kingdom, with which they were to join an army of 20,000 or 30,000 crusaders to be landed from Spain. Although no arms, after the most rigorous search, no ammunition, no money, no commissions, no papers, no letters, were discovered to confirm the evidence of these men, yet the story obtained general belief, and excited a general panic. To increase the excitement Bedloe published a pamphlet, entitled *A Discovery of the horrid Popish Plot for burning London and Westminster, &c.*, in which all the fires that had happened for several years were ascribed to the Jesuits. Meanwhile the pretended conspirators were brought to trial. Coleman, a Jesuit named Ireland, Grove, and Pickering, who, it was pretended, were engaged to shoot the king, were condemned to death on the testimony of Oates and Bedloe, and executed. The pretended murderers of Godfrey next suffered the

same fate, on the sole testimony of Bedloe, and one France, whom he had accused of being an accomplice in the murder, and who, after many promises and threats, finally confessed his guilt. Further prosecutions took place in the following year, when several persons were executed, and a new plot, called the *meal-tub plot*, from the place where the papers relating to it were found, was got up by one Dangerfield, a convicted felon. In 1680 Viscount Stafford was impeached by the Commons, condemned by the Lords, and executed, December 29, as an accomplice in the plot, on the testimony of Oates and two of his associates, Bedloe having died not long before. This was the last instance of bloodshed in this strange affair. Soon after the accession of James II. (1685) Oates was tried and convicted on two indictments for perjury, and was sentenced to be whipped on two different days from Aldgate to Newgate, and from thence to Tyburn, to be imprisoned for life, and pilloried five times every year. Referring to the Popish plot, Hallam justly remarks that, 'though it was a most unhappy instance of the credulity begotten by heated passions and mistaken reasoning, yet there were circumstances, and some of them very singular in their nature, which explain and furnish an apology for the public error, and which it is more important to point out and keep in mind, than to inveigh, as is the custom in modern times, against the factiousness and bigotry of our ancestors. For I am persuaded that we are far from being secure from similar public delusions, whenever such a concurrence of coincidences and seeming probabilities shall again arise, as misled nearly the whole people of England in the Popish plot.'

POPLAR (*Populus*), a genus of plants belonging to the natural order Salicaceæ, or, according to some, to the sub-order Amentaceæ and to the Diccia Octandria of Linnæus. The species are trees often of large dimensions, having their buds usually covered with an aromatic and viscous substance; their flowers disposed in aments, and always appearing before the development of the leaves; and these last alternate, rounded, or triangular, serrate or dentate, and supported on long petioles, which are more or less compressed, particularly towards their summits. This conformation occasions a peculiar vibratory motion in the leaves when they are acted upon by the wind, especially remarkable in the Aspen, which appears to be perpetually agitated. On account of their rapid growth poplars are frequently planted in bare localities, as they may be expected to furnish an almost immediate effect. The timber of the poplar, which is white, light, and soft, is used for various purposes, but is not very valuable. About twenty species are known, all confined to the northern and temperate regions of the globe. Among the more remarkable of these may be mentioned: the Gray Poplar (*P. canescens*), a large spreading tree, of vigorous growth, and a native of Britain; it flowers in April, and the seeds are generally ripe in June; in a favourable situation it grows from 30 to 40 feet in ten years; its timber is generally used for the same purposes as common deal. The White Poplar (*P. alba*), resembles the last in appearance, though it is not so vigorous; the upper surface of the leaf is of a darker green, and the under side is of a brighter white. The most beautiful variety of this species is the Egyptian Poplar—the Aspen (*P. tremula*), indigenous to Britain and to mountainous situations throughout Europe and Asia; it is of a stately appearance, attaining sometimes to a great height, and is extremely hardy. The bark is used for tanning leather. The Lombardy Poplar (*P. fastigiata*) is a native of Italy, and now quite common in Britain; it is readily distinguished from every other species by its upright growth, and

the taper shape of its head, from having its lateral branches closely gathered round the stem. Its wood is soft and light, suitable for packing cases, barrows, buckets, and the like. The Black Italian Poplar (*P. monilifera*), called also the Canadian Poplar, is a tree of very rapid growth, becoming of timber size in a few years. It is profitably grown for flooring, &c. Lastly, we shall mention the Balsam Poplar (*P. balsamifera*), a native of North America, where it attains a height of 80 feet; but in Britain its stature is much less; it grows vigorously for a few years. It is purely ornamental. The young wood is of a rich chestnut colour, and the buds are large and incased in a glutinous balsam.

POPLIN, a kind of finely woven fabric, made of silk and worsted. In the best poplins the warp is of silk and the weft of worsted, a combination which imparts peculiar softness and elasticity to the material; in the cheaper makes cotton and flax are substituted for silk, which produces a corresponding deterioration in the appearance of the stuff. The manufacture of poplin was introduced into Ireland from France in 1775 by Protestant refugees, and Ireland is still famous for its production. The term 'poplin' is a corruption of the French *popeline*.

POPOCATEPETL (Aztec, *popoca*, to smoke, and *tepetl*, a mountain), a volcano in Mexico, in the province of Puebla; lon. 98° 33' W.; lat. 18° 36' N. This volcano is constantly in action, throwing out smoke, ashes, and fire; but no great eruption has hitherto taken place. Its figure is that of a truncated cone, with a large crater, about 3 miles in circumference and 1000 feet deep. It is 17,783 feet high, and is one of the highest mountains between the Bay of Panama and Behring's Straits.

POPPY (*Papaver*). The species of poppy are herbaceous plants, all bearing large, brilliant, but fugacious flowers. The White Poppy (*P. somniferum*) yields the well-known opium of commerce. (See OPIUM.) Most of the species are natives of Europe, often occurring as weeds in fields and waste places, and frequently also cultivated in gardens for ornament. On the Continent the white poppy is extensively cultivated for an oil which is yielded by the seeds, and employed for culinary purposes much in the same way as olive-oil. The roots of the poppy are annual or perennial; the calyx is composed of two leaves, and the corolla of four petals; the stamens are numerous, and the capsule is one-celled, but divided internally by several longitudinal partitions, and contains a multitude of seeds.

POPULATION. No feeling is more deeply seated in the human breast than the desire of offspring. The mere instinct of propagation which man has in common with all other animals, acquires in his case an extension and power from his intellectual elevation and the greatness of his nature, which is impossible in the case of the lower animals; and when to the social and other considerations, the influence of which is peculiar to mankind, we add the attractions which imagination lends to the passion of love, and the power which that faculty possesses of compensating for the brevity and uncertainty of life, by projecting it with a semblance of reality and identity of interest into succeeding generations, it will readily be perceived that, however frequently celibacy may be enforced by circumstances, or prompted by religious zeal, a purely voluntary abstinence, unmotivated save by want of inclination, or the strength of opposing tastes, will always be so rare as to be wholly inappreciable in its general effects, so that its complete absence may be assumed as the basis of a scientific discussion of the laws of population. But although taking mankind in the mass the individual desire to contribute to the increase of the species may be held

to be universal, the actual growth of the population is nowhere entirely left to the unaided force of this motive. In respect to the gratification of this desire men are to some extent rivals, because, except in new communities, there are few societies in which all can have the opportunity of gratifying it; yet this rivalry is less felt than the sympathy which all have in common with a universal sentiment; and there are common as well as individual motives for encouraging population, to which this sympathy gives greater activity. Hence, in almost all primitive societies, and in many advanced ones, marriage, as the means of contributing to the maintenance and growth of population, has been regarded, if not as a matter of positive religious obligation, yet as possessing a natural moral sanction of almost equal weight, and to obviate any obstructions which the organization of society might put in the way of its universality, it has been held to be a matter of state policy to encourage it by positive laws. Besides the natural sentiment an adventitious circumstance has greatly contributed to make the encouragement of population a constant object of state policy. Mankind has hitherto lived in a state of chronic warfare. Contiguous nations, both barbarous and civilized, continue to maintain, as they have always maintained, their possessions against each other by a show of force; and from time to time questions arise between the most advanced nations, which are only settled by extreme violence, and a wholesale destruction of human life. However melancholy this condition of human society may be, it has to be reckoned with as a fact, and as no means have yet been discovered of remedying it, such outbreaks of destructive violence may be looked for in the future as in the past. Now there are several effects which this state of things has upon the growth of population which have an obvious influence on state policy. As long as a state of violence is normal, as long even as it may be resorted to on an extreme emergency, a motive for the growth of population is created which is independent of the resources of the community, or of the means of affording happiness or supplying material comfort to those who are called into being. Where war is the question numbers are strength, and other things being equal the community which can bring most men into the field will prevail. Heaven helps the strong battalion, is an approved maxim of trade-craft with men of the sword and rifle. Hence, whether for defence or attack, whether from motives of fear and jealousy or ambition, the numbers of a community become a matter of vital importance, and the question which, from the vulgar stand-point of common statesmanship, it is natural to put is, not how many can the country support well? but how many can it support at all? But the state of warfare, while it raises the motive for encouraging population beyond the bounds of common prudence, or indeed of any other restriction, puts very distinct and frequently very severe restrictions upon the means of effecting the object. Soldiers are necessarily withdrawn from productive industry. During all the time of training and actual warfare, which in the case of standing armies is permanent, their labour is precluded from contributing to the fund by which the population is maintained, and out of which alone can come the means of increasing it. Owing to this and other circumstances a soldier's life is, to a considerable extent, one of enforced celibacy, and while a considerable number of men in the flower of life are prevented from contributing in the proportion they would naturally do to the growth of the population, the support of these celibates forms a burden on the rest of the community which restricts its means of increase. In actual war there is in addition

to the ordinary burden the drain of human life, and the enormous expense at which war is maintained, while when the war is over the ranks of the army are recruited from those who remain, and the normal burden is not diminished. When a soldier is killed he ceases to be of any use for promoting population, but if he were not replaced the community would be relieved of the burden of keeping him; but as another is put in his place the community is weakened by a man, has still this burden to bear, and has besides to pay for the expense of killing the lost man, which is considerable. That nations under these circumstances uniformly prosper and grow in numbers says much for the natural strength of the reproductive principle. Another consideration, besides the exigencies of aggression or defence, has contributed to make the promotion of population a political object. The governing classes are usually the holders of property, and density of population increases the value of property, irrespective of the happiness or misery of the population as a whole. That which gives value to property is labour, and the greater the number of labourers in a community the greater will be the amount of service which the holders of property will be able to obtain in return for the use of their property.

The natural sentiment in favour of reproduction affects not only the religious and political, but the social and commercial views of men. Marriage is in all communities undoubtedly held to be a condition of honour as well as of bliss. Social distinction and innumerable minor privileges await it, and the natural incentives to adopt this state are thus largely increased, and in a way which is specially attractive to the young and inexperienced. Commerce adds a speculative element to the inducements to matrimony. It not only holds out hopes which encourage men to anticipate the calculations of prudence, but it makes marriage itself an available resource which can be counted on as having a distinct mercantile value. The universal sentiment in favour of marriage causes it to be regarded as a sort of certificate of character and guarantee of stability in a young man. Even when the act itself is imprudent he gains by it among those who have no special knowledge of the circumstances a *prima facie* reputation for prudence, and as it were steals a character by flattering the current prejudice. But commerce is itself only a species of war. Its votaries have a faith in the inexhaustibility of its resources as implicit as that of despots in the power of their legions; but as there can be no commerce in that which is not produced, commerce is as strictly limited by production as war is by the resources of those at whose expense it is carried on.

On a *prima facie* view of the problem of population then it appears that while there are in the organization of society itself considerable hindrances to the full development of the powers of reproduction inherent in the human race, the prevailing sentiment of mankind, as represented in religion, politics, social usages, and commercial enterprise, has been uniformly in favour of encouraging the use of these powers, so that the growth of population has come to be commonly regarded as an indispensable sign of the prosperity of a community.

The policy of population thus indicated, though founded on a natural sentiment, supports itself on so many aggressive movements—conquest, commerce, emigration, that it may not inaptly be designated as the war policy. In proof of its prevalence the laws and institutions of many ancient nations—Hindus, Chinese, Persians, Romans, might be cited, but it would be useless to give particular instances of what is all but universal. Even at the present day this

policy is upheld by a vast preponderance of popular opinion, and is not without scientific support. It is questioned only by a few political economists, whose views are generally met by misrepresentation.

The limited area and high civilization of Greece first suggested the view of the question which contemplates the dangers of over-population, and it was among her eminent philosophers and statesmen that the problem of population began to be considered in all its aspects. Plato and Aristotle (who writes on the subject like John Stuart Mill) propounded theories for the regulation of population, not such as would suggest themselves to modern views of humanity, but sufficient to indicate a keen perception of the natural tendency of population to overgrowth. But the times were unfavourable for giving practical effect to such views. The small states of Greece were constantly at war with each other when they were not engaged in repelling or in organizing foreign invasion, and they made free use of the resource of emigration. Hence the legislator of Sparta, the leading state of Greece, did all he could, according to his light, to encourage population, and this policy was generally followed in Greece, as elsewhere. The whole policy of Rome was opposed to the formation of any opinions founded on a non-aggressive view of the organization of society, and the state of the civilized world during the middle ages afforded equally little scope for the formation of such opinions. Thus the problem of population was relegated to modern times.

It was in an *Essay on the Principle of Population*, published in 1798 (revised in various editions from 1803 to 1826) by the Rev. T. R. Malthus, subsequently professor of political economy in the East India Company's College at Hailebury, Hertfordshire, that the question of population was first systematically treated, and in this work the theory of population is so stated and demonstrated that the principles of Malthus must hereafter form the foundation of any science of political economy worthy of the name. The work of Malthus has never rivalled in popularity that of Adam Smith on the *Wealth of Nations*, and it has been subjected to a kind and amount of vituperation to which Smith's was never exposed. Smith attacked the prejudices of his day, and when these were overcome he received without opposition his due meed of fame. Malthus has probed the fallacies of prepossessions which are those of human nature, and which spring up afresh in each generation. His opponents are consequently immortal, and even among the professors of political economy those who receive his views without caveat can hardly yet be reckoned the majority. Even the most ardent admirers of Malthus hardly venture to class him with Adam Smith; yet if the intrinsic value of the positions demonstrated, and the beauty and completeness of the demonstration are to determine the rank of a scientific work, that of Malthus can hardly be reckoned second to any other within the sphere of economy. To Smith, on the other hand, belongs the honour of being the pioneer of the science, and what is of more importance to his fame, his principles have been turned to practical account, while the day for the practical recognition of Malthus is yet to come, and his theory still remains the mere bugbear of the sentimentalists.

The preliminary observations on which Malthus founds his theory had often been made by economists, naturalists, and other writers. Malthus quotes an observation by Dr. Franklin, which supplies in a striking manner the fundamental fact on which the theory of population rests, that there is no bound to the prolific nature of plants or animals but what is made by their crowding and interfering with each

other's means of subsistence. Were the face of the earth vacant of other plants, it might be gradually sowed and overspread with one kind only, as for instance with fennel; and were it empty of other inhabitants, it might in a few ages be replenished from one nation only, as, for instance, with Englishmen. Malthus also shows that in several minor countries voluntary checks to population, more or less effective, have been in operation. From the experience of America he lays down the position that a population unimpeded by artificial checks might double itself in twenty-five years. Actual statistics, as cited by Malthus himself, and as given by subsequent statisticians, point to a much shorter period, but this is immaterial. Taking a given area, such as that of Great Britain, Malthus supposes that by the best agricultural policy its produce might be doubled in twenty-five years. This rate of progression, however, could not be continued. Assuming that there is no practical limit to the increased fertility of land under the most effective husbandry, he assigns to this increased fertility as a limit more favourable than experience will allow, a continuance without diminution of the original rate of increase. Thus at the end of the second period of twenty-five years the produce would be to that at the end of the first period in ratio not of 4, but of 3 to 2. Applying this to the whole earth it is obvious that unimpeded population would increase in successive periods in the ratio of 1, 2, 4, 8, &c., and that after a given stage of cultivation had been reached, production would only increase in the ratios of 1, 2, 3, 4, &c. In this way the whole area of the earth would soon be occupied, and further increase, except in the restricted ratio of production, would become impossible. These facts Malthus generalizes by saying that population increases in a geometrical, while the means of subsistence only increase in an arithmetical ratio. It is this superior energy of reproduction which explains such facts as have already been adverted to in this article. To this is due the fact, that in spite of the ravages of war, famine, and disease, of the influence of trades destructive of life, and of artificial habits and vices which retard or hinder reproduction, the population of the earth, and in general of each particular country, is not only maintained, but continues to progress.

Population of course cannot continue to increase beyond the means of subsistence, and every actual increase beyond actual or immediately attainable means must lead to a destruction of life. In examining, however, the bearing on each other of the different ratios of increase of human life itself, and of the means of supporting it, Malthus has deduced a law to the proof of which a considerable portion of his work is devoted. It is upon this law that the practical importance and value of his theory depends, and it is on account of it that it has been so much misrepresented and so violently assailed. This law is that the energy of reproduction rises above all the ordinary accidents of human life and the inevitable restraints imposed by the various organizations of human society, so that in all the various countries and climates in which men have lived, and under all the constitutions by which they have allowed themselves to be governed, the normal tendency of population has been to press continuously upon the means of subsistence. If we take, for example, two extremes of good and bad government, say England and Turkey, we find under the one a scope given to the growth of population which is wholly wanting in the other. But if population should be advancing in England, and declining in the most neglected or misgoverned parts of the Turkish Empire, the cause of advance in one case will be the cause and security

with which the means of subsistence can be developed; the cause of decline in the other will be the depression of industry through the arbitrary exactions of the agents of government, and the insecurity of property from the insufficiency of the protection afforded to it. And in the advancing and the declining state alike the same phenomenon will be found, population pressing up to and touching the actual limit allowed by the means of subsistence.

But if population is thus actually limited by the means of subsistence, it cannot be prevented by these means from going further than these means will warrant. The check from the means of production will come, but only after population has exceeded them. It becomes then an inquiry of great importance by what kind of checks population is actually brought up at the point at which it is in fact arrested. This inquiry Malthus conducts along with the proof of the law of pressure of population on the means of subsistence, which forms his fundamental position. The one inquiry in fact illustrates and confirms the solution of the other.

Malthus divides the checks on population into two classes, preventive and positive, the one consisting of those causes which prevent possible births from taking place, the other of those which, by abbreviating life, cut off actual excesses of population. In a further analysis of these checks he resolves them into three—vice, misery, and moral restraint. This is in fact a cross division, as vice and misery include both positive and preventive checks.

The proof of his main position is historical and statistical. He adduces evidence from a great variety of sources bearing on the state of communities from the lowest to the highest stage of social organization, and including the leading nations both in ancient and modern times, and the result is a body of proof the uniformity of which could scarcely have been anticipated previous to systematic investigation. It is shown, for example, that in countries which, according to our notions, we might imagine to be very inadequately peopled, among the American Indians, for example, or the nomad tribes of Northern Asia, the pressure of population upon the means of subsistence is as clearly to be traced as in the most densely-peopled countries. The measure of the growth of the American Indians, for example, was the extent and productiveness of their hunting-grounds. In these, even when occupied only at a particular season, they claimed a right of property, and the violation of a seemingly unoccupied territory was to them a matter of as serious importance as that of a cultivated estate in a civilized country, and occasioned wars among neighbouring tribes just as similar encroachments do among civilized nations. It is thus easy to see how the Indians must have declined in numbers with the encroachments of the white men, and how reasonable a cause of hostility these encroachments afforded them. A similar proof is derived from a retrospective application of the theory to history, which is of great independent value. Historians had long been at a loss to account for the seemingly inexhaustible hordes which the comparatively barren regions of the north of Europe and Asia had been able to pour during protracted periods of time, as for example during the decline of the Roman Empire, upon the comparatively fertile south, and had been led even to conjecture that the north must then have been more densely peopled than now. Even Gibbon, who rejected this explanation, seemed to think that the growth of population in these regions must bear a direct ratio to its density, which leaves the facts of the case unaccounted for. Malthus finds the explanation in the wholesale emigration and consequent rarity of population itself.

Upon his principle the elasticity of population must in fact be in inverse ratio to its density. When the attractions of a southern campaign withdrew a large mass of a northern population from its homes there was for a time no pressure to restrain the rapid growth of those who remained, which would at once rise up to something more or less near according to circumstances, to its geometrical limit, and in less than an ordinary generation. A fresh horde, inspired with the traditions of former successes, would be able to start from the same locality. Thus it was the very fertility of the south which in these days of violence kept the population of the north below its normal limit, and so made it a nursery of men. These invasions, it is to be remembered, were not mere drains of men, but in general real emigrations by families and tribes, which would not leave those who remained behind burdened with useless dependents.

In regard to the subsidiary inquiry the most striking point brought out is the rarity of moral restraint and the uniform action, in innumerable forms, of vice and misery. A crucial test of the inevitableness of the alternation between these checks is given by Malthus from the accounts of Cook and others of the South Sea Islands, and particularly of Otaheite. Here the salubrity and fertility of the climate banished disease, and gave within the limits of its area the utmost facilities for increase. On the other hand the populous character of all the neighbouring islands made emigration impracticable without war; and war, though frequent, was not sufficient to restrain population. Here was found in full operation an institution which, as an organization of vice, would do honour to the most civilized community. Among the higher classes of Otaheite there existed societies called Eareeoie, which were joined by the *élite* of both sexes, and the object of which was promiscuous intercourse without the procreation of children. When an Eareeoie woman was delivered of a child a piece of cloth dipped in water was applied to the nose and mouth to suffocate it. The manners of the common people were in accordance with the example set them by their superiors.

The replies to Malthus consist almost exclusively either in misrepresentations of what he has attempted to prove, or in partial views of the question. The former are astonishingly frequent, and the most absurd statements have been attributed to Malthus from his own day to this. One which he cites himself in his Appendix (1817) from the replies made to his work may serve as an example. 'Others, of whom Mr. Malthus is the leader, regard the vices and follies of human nature, and their various products, famine, disease, and war, as benevolent remedies by which nature has enabled human beings to correct the disorders that would arise from that redundancy of population which the unrestrained operation of her laws would create.' Hazlitt doubts if Malthus did not at first hazard his theory as an amusing and extreme paradox; and John Hill Burton has expressed a view which still prevails with many political economists, that he failed to consider the influence of free trade, 'which puts all the world at the command of an increasing and producing people.'

Malthus's theory of the ratio between human powers of reproduction and the increase of the means of subsistence has indeed been questioned. It is frequently called exaggerated by those who assign no reason for doing so, but a form of argument used in reply to it is that animal growth is slower than vegetable, and that man being one of the most slowly-developed animals, his growth is among the slowest of those of organized beings, and that his increase must therefore be slower than that of his means of

subsistence. If one corn would suffice for one human being until another corn was grown, there would be abundant force in this argument until the world was so full of human beings that there was not room for a corn for each of them; but as each human being requires many corns, each must have a certain amount of space to grow them in, and if the growth of corn itself is limited by the area of fertile land, that of human beings must be much more so. A very common mode of replying to Malthus is to restate one of his checks to population in different words, and call it a reply to his theory. But by far the most mischievous mode of dealing with Malthus's theory is that most commonly adopted by hostile economists, to profess to accept it as abstractly true, but to treat it as a merely speculative truth of very remote practical application. Two things are generally relied upon by those who take this position to ward off the present application of the theory from a particular state—emigration and trade. Emigration can never be an efficient remedy for over-population, for two reasons. A spontaneous emigration to an extent to affect population can never take place except under the pressure of the misery resulting from over-population. And when the emigration has taken place it does not remove the spring of over-population, but increases its elasticity. The pressure of population is speedily renewed, and the same process has again to be repeated. Thus emigration presents at best an alternation of accumulating misery and partial relief. Trade, 'which puts all the world at the command of an increasing and producing people,' presents for the time at least a more substantial and satisfactory relief, and to those who can conceal from themselves the true nature of the problem which Malthus has proposed this may seem to put its practical application to an indefinite distance. That a trading country is not wholly dependent upon agriculture, and that as long as there are vast tracts of fertile territory thinly peopled, such a country may maintain a population greatly in excess of what its own agricultural resources would be able to provide for, is certain. It is conceivable that such a country may advance in population beyond its actual agricultural resources, and yet increase in prosperity. Even when the world has reached its maximum of population, there will still be trading and agricultural districts, and the former will be more densely peopled than the latter. The most favourable instance that can be found by those who adopt this reasoning of a country in the supposed position is Great Britain. Looking to its mining wealth, and manufacturing and trading facilities, they suppose that this country stands to the rest of the world in a relation somewhat analogous to that of a town to the surrounding country, so that they object to assign any limit to its population from agricultural and even from any kind of internal resources other than the industry of its inhabitants. Now in giving this description of its position these economists have only shown, contrary to their intention, that there is no case more urgently calling for the application of Malthusian doctrines, or more permanently dependent on them, than that of Britain. It is always in the town and not in the country that the worst evils of over-population develop themselves, and whatever may be the resources of a community, the progress of population is equally liable to press upon their actual development.

For, first, the position here described, and which is in reality that which Britain occupies, is a perilous one. It would, of course, be arbitrary and absurd to limit the population of a country like this to its agricultural resources; but there is not the less a natural gradation in the stability of the resources on which a country may rely for the most indispensable

part of its means of maintenance, food subsistence. First in order of course come agricultural resources. Next may probably be placed mining and other industries which rest on actual material resources of the country. These are not only more liable to failure than agriculture, but are also exposed to variations in the value of the exported products from similar discoveries elsewhere. After these come manufactures resting on no special facilities. Such industries are very liable to fluctuation, and we have frequent instances of their changing from one locality to another. When they are relied on as a means of bringing food from abroad they come within the range of foreign competition, and the further they are pushed for this purpose the wider and the more difficult of defence becomes their outer line. Last of all comes pure commerce, or the exchange of the products of others. A seaboard is a permanent natural resource for commerce, but this is of itself only an auxiliary means. When it is available for the development of internal resources, or the exchange of home produce, it affords scope for a commerce of proportionate stability, but mere indirect exchange must always, in the nature of the case, be a precarious source of revenue. When a community depends upon all these sources together it has the greater need to keep its population well within the limit of its developed resources, so that it may be the readier to meet any emergency.

But, secondly, the whole of this argument is founded on a complete misconception of the scope of the Malthusian problem. Malthus has shown that at the natural rate of increase the population of the whole earth would double every twenty-five years at the outside. There is still plenty of room in the world. Why does it not go on doubling? Because of the operation in the populous districts of the three checks—vice, misery, and moral restraint. Population, as it does not spread, is actually pressed together in the populous districts, and subjected to these restraints. Now of these restraints there is one only which it is not desirable to abolish, and that is the one which is found most rarely in operation. Moral restraints may differ in degree of excellency as well as others, but taking the good along with the bad, the question is whether, even in the most civilized community, the growth of the population is kept at its actual level by moral restraint of any kind, or by vice and misery, and whether the human race as a whole has profited by its intelligence to regulate its own increase, or at best suffers it, like the lower animals, to be regulated by the external forces of nature. Those who take the optimist view of the question look with complacency to population returns, and declare their satisfaction with the actual rate of increase. They perhaps go the length of a general inference from the present and past conditions of the people, but they do not face the actual details of our progress. It is very well to argue that because the average duration of human life has been extended, and the standard of comfort of the population raised, we are at least in a progressive position in regard to this problem. But the general argument is not conclusive. Neither Malthus nor any one else has said that all vice, disease, and misery were due to over-population. It is certain that science has diminished other causes of disease, and therefore an increased duration of life does not prove the mitigation of this cause. It is also a mistake to suppose that a higher standard of living removes the danger of over-population to a greater distance. It is from the pressure of population upon the minimum standard, whatever it is, that the danger accrues. What happens when this pressure occurs is not that the standard is immediately lowered—that may be done

by a continued pressure—but the immediate results are misery and vice. That the British are subjected to such a pressure in no slight degree will be evident to any one who considers, not the actual growth, but the tendency of the population to grow, as exhibited in the single circumstance of the excessive infant mortality of large towns. If all these children grew up population would increase rapidly, and there would either have to be a great expansion of the means of subsistence, a lowering of the standard of living, or a greater mortality among adults. Through an extraordinary combination of circumstances this problem has come to concern the British perhaps more than any other people in the world. Their case has been stated, but we have also to consider that of India, the second most densely peopled country in the world (according to some statisticians the first), and one of the most rapidly progressive in population. Britain has been blamed for putting a stop to the wars by which that population was checked, and as in the case of India authority must for a long time do anything that is to be done for the general good of the people, while in England the interference of authority on such a question would not be tolerated, we have the opportunity of studying both phases of the question.

The application of the principles of Malthus to the science of economy has yet to be made. Malthus's own application is chiefly local. He discusses at considerable length the bearing of his theory upon the English poor laws and upon some of the economical questions of his day, and he has some good observations upon the influence of public opinion on the growth of population, and the effects to be anticipated from a thorough education in sound views of the subject, a consummation still as distant as in his own day; but in regard to the general principles of the science his view may be summed up in saying that if population is to be controlled by vice, misery, or moral restraint, moral restraint is better than vice or misery.

Dr. Chalmers thoroughly adopted the principle of Malthus, but like Malthus he points to a moral rather than an economical conclusion. Chalmers, in fact, formally despairs of the economical problem, and he reviews the whole sphere of economy in order to prove that we are shut up to a moral remedy. Now it is true that the question in ultimate analysis is one of morality, for over-population, with its attendant vice and misery, is the result of a series of acts of selfishness and inconsideration; but as the reformation must be general we shall have to wait very long before morality will be sufficiently advanced to effect it, and in the meantime the immoral people will be constantly increasing. Economy, therefore, cannot resign her proper function of trying to make the best of what morality we have.

It was one of the great merits of John Stuart Mill as an economist that he saw the full importance of the Malthusian problem. Mill takes the opposite course with it from Chalmers, and, in strict accordance with his utilitarian principles, brings morality down into the region of economy to meet it. This makes his treatment of the question resemble that of the Greek philosophers. But it is sufficient to say that the morality of Mill is not, and is never likely to become, the morality of the human race. Like Malthus he relies much upon public opinion, but he shows too much disposition to dictate to it.

PORCELAIN. See CHINA-WARE and POTTERY.

PORCH, an exterior appendage to a building, forming a covered approach to one of its principal doorways (Gwilt).

PORCIA, daughter of Cato of Utica. She first married M. Bibulus, Caesar's colleague in the consul-

ship (B.C. 59), by whom she had three children. Bibulus died in B.C. 48, and in B.C. 45 she married M. Brutus, who afterwards became the assassin of Caesar. She is said to have induced her husband to confide the secret of the conspiracy to her, and on the day of its execution her anxiety for his safety was so great that she fainted away. After the death of Brutus she put an end to her life. The common story was that her friends having removed from her the means of self-destruction she effected her purpose by swallowing live coals. It is scarcely necessary to contradict this tale, which it is conjectured covers the fact of her having suffocated herself with the fumes of charcoal.

PORCUPINE, a genus of quadrupeds belonging to the Rodent or Gnawing order of Mammalia, and forming the type of a distinct family, that of the Hystricidæ. These forms are distinguished by the peculiar nature of the body-covering, which consists, especially in the back region, of hairs specially modified to form the so-called *quills*, or dense, solid, spine-like structures. These quills are intermixed with bristles and stiff hairs, and in some American species the quills are almost concealed beneath the hairy fur of the body. The incisor or front teeth number two in each jaw, as in the generality of Rodents. These teeth spring from permanent pulps, so that they continue to grow throughout the lifetime of the animal as in the other members of the order. The arrangement of the enamel and the dentine or ivory of these front teeth also tends to perfectly adapt them for their 'gnawing' operations. (See RODENTIA.) There are four molar teeth on each side of each jaw in the porcupines, these latter teeth exhibiting complicated foldings of the dentine or ivory substance bounded by enamel; and the molar teeth in the porcupines, like the incisors, continue to grow throughout life from persistent roots. The skull exhibits an infra-orbital foramen of very large size. The muzzle is generally short and of pointed conformation. The lip is divided. The ears are short and rounded. The anterior feet possess four, and the hinder feet five toes, all provided with strong thick nails. The clavicles or collar-bones are of rudimentary nature. The tongue is roughened, or, as in the Javan porcupine, may be provided with horny plates or scales.

The family Hystricidæ includes several distinct genera. Of these the first and most familiar is that of *Hystrix*, represented by the True Porcupines. Of this genus the Common or Crested Porcupine, *Hystrix cristata*, found in Southern Europe and in Northern Africa, is the best known species. The True Porcupines have non-prehensile tails, which may be spiny or covered with scales or bristles. When fully grown the Common Porcupine measures nearly 2 feet in length, and some of its spines exceed 1 foot. Its general colour is a grizzled, dusky black. The upper part of its head and neck is furnished with long, light-coloured hairs, capable of being raised or depressed at pleasure; and most parts of the back and sides are armed with spines, which are longest on the centre of the back. In their usual position they lie nearly flat upon the body, with their points directed backwards; but when the animal is excited they are capable of being raised. This elevation of the spines is effected by the development of special skin muscles, collectively named the *panniculus carnosus*. This same muscle is developed in the hedgehog, and enables that animal to roll itself up in the well-known fashion. The spines are banded black and white, and are extensively used as holders for steel pens and for paint brushes. The quills are loosely inserted in the skin, and may, on being violently shaken, become detached—a circumstance which may probably have given rise

so the purely fabulous statement that the animal possessed the power of actually ejecting its quills like arrows or darts at an enemy. Aristotle, Pliny, and Oppian mention this as a veritable fact, whilst another statement was gravely made of the porcupine that it actually carried water for its young in the presumed hollow quills of the tail! These animals generally lead a solitary life, and inhabit burrows during the day, coming forth at night in search of food, which consists chiefly of vegetable matter. The common species is quiet and peaceable, but shows no disposition to become familiar or domesticated. An Indian form (*H. Nepaleensis* or *leucurus*) resembles the Crested Porcupine in form, but is larger, and possesses white spines on the tail. No hairy covering exists; and the nails are shorter, the ears being less rounded than in the European form.

The porcupines generally inhabit warm or tropical regions, and are represented by distinct genera in both hemispheres. The name 'porcupine' itself is derived from the French, and signifies 'spiny pig'—a designation not altogether inappropriate, if the pig-like form of the animals and the grunting sound they produce are taken into consideration.

The genus *Atherura*, including two species, possesses a long scaly tail, which is terminated by a tuft of bristles. The species of this genus occur in India and other parts of Asia and in the Eastern Archipelago. The *Atherura fasciculata* or 'Fasciculated Porcupine' is a familiar species of this genus. Its colour resembles that of the Common Porcupine, the upper parts and outer sides of the limbs being coloured of a dusky hue; whilst grayish-white prevails in the under parts, the inner sides of the limbs, and the front of the neck and throat. A transverse black band marks the breast above the fore legs.

Of the American species, the Canadian or North American Porcupine (*Erethizon dorsata*) is the best known. The quills in this species are short, and are concealed amongst the fur. This species is of slow, sluggish habits. The ears are short, and hidden by the fur. The tail is comparatively short. It is about 2 feet long; of a brownish colour, mingled with white; the spines are attached in a very slight manner to the animal, and, from being barbed at the tip with numerous small reversed points or prickles, they by degrees penetrate very deeply into the flesh after having once pierced it. Small and insignificant as these defensive weapons may appear, they are capable of causing the death of dogs, wolves, or indeed of any animal that incautiously attempts to seize the porcupine. These spines or quills are much used among the Indians to ornament different articles of dress: they dye them of various colours, in a very permanent manner. The Canada porcupine is principally found in the northern parts of the United States and in Canada, the northernmost limit of its distribution being at latitude 67° N., on the shores of the Mackenzie River. It is said to be rare in Virginia, but numerous in some parts of Kentucky. They feed on the barks of various trees, apples, corn, &c. Their flesh is said to be very unpalatable, resembling flabby pork. They pair about the latter end of September, and the female brings forth two young in April or May.

The genus *Cercolabes* of South America possesses a distinctive feature in the elongated prehensile tail, adapting it for an arboreal existence. These latter forms may thus be termed 'Tree Porcupines.' About six species of these animals are indigenous to America, the spines, as in the Canadian Porcupine, being of much smaller size than in the Old World forms. In length the typical species of this genus averages 1½ feet, the tail measuring about 10 inches.

Other genera are *Syntherus* and *Aulacodus*. The

former includes only the Mexican Porcupine, the latter occurring in West and South Africa. The bodies and tails of the species of the genus *Aulacodus* are more elongated than is usual, and the tails are covered with prickly hairs. They average large rabbits in size. See illustration at RODENTIA.

PORDENONE, a town of Italy, 40 miles N.N.W. of the city of Venice, in a plain on the Nocelle. It is surrounded with an old wall, is a well-built, stirring place; with two parish and six auxiliary churches; a theatre, hospital, and workhouse; manufactures of cotton, copper utensils, paper, and glass. Pop. 6000.

PORDENONE, IL (so called from his birthplace, Pordenone in North Italy, his true name being Giovanni Antonio Licinio or De Sacchis), or REGILLO DA PORDENONE, a painter of the Venetian school, was born about 1483, and executed many works for his native place; some also for Mantua, Cremona, Piacenza, &c.; but his greatest works for Venice. For this city he executed pictures in several of the public buildings, and was so popular that a rivalry existed between him and Titian. He died in Ferrara in 1539, whither he had been invited, by the Duke Ercole II., to prepare cartoons for Flemish tapestry. His death was attributed to poison. His pictures are scarce, but specimens are to be found in some of the principal galleries of Europe.

PORIFERA ('pore-bearing'), the name now usually given to the phylum or sub-kingdom of animals which includes the Sponges; formerly applied to the Foraminifera also. The name has been applied in allusion to the apertures or pores which exist in both groups of organisms. The Foraminifera thus possess minute apertures or *foramina* in their calcareous shells, and through these apertures the sarcodite matter of their bodies is protruded in the form of filamentous processes termed *pseudopodia*. The name Foraminifera is thus equivalent in its etymological sense to Porifera. The 'pores' in the Sponges are the smaller apertures existing in the sponge-material, and through which currents of water are continually being drawn. These apertures are therefore essentially different from those in the Foraminifera. The pores in the Sponges lead into a system of canals or channels which, after permeating the body of the sponge, open to the exterior by one or more, but always by a few, larger apertures known as *oscula*. (See also PROTOZOA and SPONGES.)

PORK, the flesh of swine, is one of the most important and widely used species of animal food. Fresh pork, though by some considered a delicacy, especially when killed young, is a much inferior article of diet to beef or mutton, and is much less used. The flesh of pork, particularly the lean, is coarser and ranker than that of the other animals chiefly used for food, but there are certain advantages which give pork a place in the supply of animal food that can be filled by no other article. The appetite of swine being much more catholic than that of their daintier neighbours, the feeding of them answers the purposes of economy, and extends very materially the supply of food. This, it is true, is attended with considerable dangers. If care is not taken that the feeding of swine should be wholesome and cleanly, their flesh becomes tainted with disease and unfit for food. Unscrupulous breeders sometimes take advantage of their exorbitant and omnivorous appetite to make them consume the most disgusting offal, and even when their feeding is not conducted with this utter recklessness of consequences it is often less careful than is consistent with sound sanitary conditions. There is in fact no animal to the perfection of whose flesh as an article of diet careful attention to feeding is more indispensable.

The main recommendation of pork lies in its superiority to other kinds of animal food in undergoing the process of curing. The quality of beef and mutton is seriously deteriorated when long kept, even under the best methods of curing; that of pork is decidedly improved, and when of good quality and well cured it develops a richness and delicacy of flavour in marked contrast with the dryness and insipidity of other salted meat. Another recommendation of pork is the abundance and very digestible quality of its fat, which makes it a very suitable diet for cold climates, but which is, on the contrary, rather a disadvantage in hot ones. For long sea voyages, especially before the introduction of modern methods of keeping fresh meat, pork was by far the most common and acceptable form of animal diet, and it is still one of the most valuable items in naval stores.

Pork was among the unclean animals forbidden to be eaten by the Mosaic law. It is still regarded by the Jews as specially typical of the unclean animals. The Egyptians, Arabians, and other eastern nations had similar opinions as to the use of pork. The breeding of swine is common among the Irish peasantry, but the chief source of the commercial supply of pork is the United States, whose pork exports (including lard) amount to about £20,000,000 annually. Pork possesses much less fibre, albuminous and gelatinous matter than beef or mutton, but compensates by its more abundant supply of fat.

POROSITY, the name given to a property possessed by all bodies; it asserts that the particles of bodies are not immediately contiguous to one another, but are separated by intervening spaces or pores. Certain kinds of stone employed in stone-filters allow water to pass through their pores, but prevent the passage of small solid bodies previously held in suspension by the water. The 'Florentine experiment' showed that gold and lead allowed water to pass through their pores. Hollow globes of gold and lead were filled with water, and securely closed; when these spheres were struck with a hammer the pressure within became great enough to force the water through the pores of the metals, making the appearance of dew on the outsides of the vessels. If measurements of volume are taken, when water and alcohol are mixed the volume of the mixture is found to be less than the sum of the volumes of the constituents, the particles having been brought closer together than before. Bodies expand and contract in volume with heat and cold; they can also be compressed by the application of forces, so that their particles cannot be in immediate contact. Iron and platinum when at a high temperature allow gases to pass through them.

That the molecules of bodies are not only separated from one another, but are always in a state of rapid motion, is a theory which is now generally accepted by natural philosophers.

PORPHYRY is a compound rock having a basis in which the other contemporaneous constituent parts are imbedded. The base is sometimes clay-stone, sometimes hornstone, sometimes compact felspar, jade, pitchstone, pearlstone, and obsidian. The imbedded parts are commonly felspar and quartz; the former in more or less distinct crystals. There are porphyries of different ages. One variety is found graduating into granite and gneiss, but this does not possess the characteristics of the rock in the highest perfection; another is found in overlying strata, and unconformable to other rocks, which is the true porphyry. Its colour is often red or green, and when polished it is valuable for ornamental work, being superior to marble on account of its great hardness. This rock abounds in Egypt, the northern parts of Europe, in Mexico, and South America. There is

still another variety found in connection with extinct volcanoes, which is sometimes distinguished by the name of *clay-porphry*. It abounds in the neighbourhood of the Mediterranean.

PORPHYRY (*Porphyrios*), a Greek philosopher of the Neo Platonic school, celebrated as an antagonist of Christianity, is called a Tyrian and a Batanean, whence it is conjectured that he was a native of a Tyrian colony at Batanea, the Bashan of Scripture. He was born, as is inferred from his own statements, about 238 A.D. His original name was Malchus, from the Syrophenician *melech*, king. Longinus, whose pupil he became, gave him the title of Porphyrius, indicative of the purple colour of royal robes. He was early placed under the teaching of Origen, and afterwards studied under Apollonius and Longinus in Athens. At the age of thirty he came for the second time to Rome to place himself under the teaching of Plotinus. Plotinus had deputed the task of initiating new pupils to Amelius. Porphyry at first disputed the doctrine taught him, in a treatise in support of the position 'that the things perceived by the mind exist out of the mind,' which he submitted to Plotinus for reply. Plotinus handed it to Amelius, who wrote a treatise in reply to it; and after some further controversy Porphyry expressed himself satisfied, and read a recantation in the school. This incident is important, as indicating the teaching of Longinus, and possibly by implication of Ammonius, the instructor of Plotinus. Porphyry finished by entirely adopting the opinions and obtaining the confidence of Plotinus, whose literary assistant and executor he became, and upon whom he exercised considerable influence in inducing him to commit his views to writing. Porphyry was naturally of a hypochondriacal disposition, and the abstruse mysticism of Plotinus incited in him a tendency to cherish thoughts of suicide, which Plotinus perceiving recommended to him a change of situation, and about 268 he went to Sicily. Here he is said to have written his treatise against the Christians, which was in fifteen books. It was publicly burned by the Emperor Theodosius, and is only known from fragments in the authors who have refuted him. Porphyry, as well as Plotinus, recognized Christ as an eminent philosopher; but he charged the Christians with corrupting his doctrines. He married, when somewhat advanced in life, a widow with seven children, and a letter is extant which he addressed to his wife. He died about 304 or 306.

The philosophy of Porphyry is completely identified with that of Plotinus, an account of which has been already given. (See **Plotinus**.) Porphyry represented chiefly the religious phase of this philosophy, and we need here only refer to its relation to the popular mythology and theurgy, which has been merely adverted to in the life of Plotinus. The best ancient philosophers found no difficulty in reconciling polytheism with the belief in one supreme and omnipotent God. The conception of created intelligences of an order superior to man furnished a solution of the popular beliefs, which did not contradict their higher speculations. Thus, Socrates had his demon, Plato believed the gods to have been created in a manner similar to man, and Plotinus and Porphyry joined a belief in good and evil demons, and a respect at least for the Greek mythology with their philosophical tenets. These beliefs have been the ground of accusations of inconsistency against Porphyry, who dwells on them occasionally in his writings. He believed, as did Plotinus, in enchantment as a means of acquiring power over demons and the souls of the dead; but he always ranked philosophy higher than mythology, and from his letter to the Egyptian prophet Anebo it appears that at a later

period of his life doubts of the popular theology, and of the theurgical notions associated with it had begun to prevail with him. The practical tendencies of his philosophy were ascetic. He held that all matter was polluted, and that no material sacrifice ought to be offered to the supreme God. With the view of restraining the sensual desires he abstained from animal food, and would also, if it had been possible, have abstained from vegetable diet. He distinguished four degrees of virtue—political virtue, or that of moderation is the first grade; purifying virtue, which sets the soul free from passion, and by means of which men are made to resemble demons, is the second grade; in the third grade, which corresponds with the absorbing devotion to philosophy, man becomes a god; and in the fourth, which answers to the ecstatic state of Plotinus, he becomes the father of the gods. He recognizes a soul in animals, and accords to them a certain amount of intelligence and reason. The scholarship of Porphyry was for his day extensive; but it was entirely subject to the allegorizing and mystical tendencies of the school of philosophy to which he belonged, and he studied the philosophers of other schools, not so much to ascertain their opinions as to find his own in them. Porphyry was a voluminous writer, but comparatively few of his works are extant. The titles of some of them are such as to convey little information to any one not versed in Neo-Platonic philosophy. Besides his editorial work for Plotinus, the most important are his *Lives of Plotinus and Pythagoras*, the latter supposed to be a fragment of a larger history of philosophers. It is a very partial production, and gives Pythagoras a much higher rank in the history of philosophy than he is entitled to. Among his other works we may mention, *Principles concerning Intelligibles*, a resumé of the Philosophy of Plotinus, and the *Cave of the Nymphs in the Odyssey*, a contribution to a symbolical interpretation of Homer. There is no complete edition of the extant works of Porphyry. Nauck's *Opera Selecta* (1886) contains *Life of Pythagoras*, the *Cave of the Nymphs*, *On Abstinence from Animal Food*, *Epistle to Marcella*; Wolf Edited *De Philosophia ex Oraculis haurienda* (1886), and Schrader *Questiones Homericae* (1880-90).

PORPOISE, a genus of Whales or Cetacean Mammalia, belonging to the family Delphinidae (Dolphins, &c.) of that order. The Common Porpoise (*Phocaena communis*) is at once the most familiar and the smallest of the Cetacea, and occurs plentifully off the coasts of Britain and in the North Sea. The nearly-allied Grampus (*P. Orca*) is included in the same genus with the Porpoise. The name Porpoise is derived from the French *porc-poisson*, or 'hog-fish,' and the term has evidently allusion to the black pig-like form and gambols of these forms; the German term *Meerschwein* possessing the same significance, and also the more familiar French name of *Marsouin*. In the Porpoise genus the head is blunt, and does not project anteriorly to form a beak or rostrum, as in the Dolphins. Teeth exist in both jaws, and a dorsal fin exists, being placed far back on the dorsal surface. An allied species is the *P. Melas* (or *P. Globiceps*), the 'Round-headed' Porpoise or 'Ca'ing Whale' of the Shetlanders, which occurs in flocks, and which exemplifies strong gregarious habits. These latter forms are much larger than the Common Porpoise, and measure on an average from 20 to 24 feet in length. The head is very convex and rounded. The 'Ca'ing Whales' inhabit the northern seas, and are hunted for the sake of the oil. They are captured by driving them towards the shore, the entire flock generally following the example of any one member which becomes stranded. The bellowings of these forms are described as being exceedingly

loud and noisy. The term 'Bottle-nosed Whale or Porpoise' is sometimes applied to this latter species; the name of whale being of course misapplied when considered with reference to the strict zoological position and relations of the Porpoises.

The Common Porpoise attains an average length of 5 feet. The smooth skin is destitute of hairs, save in the neighbourhood of the mouth in the young state. The front portion of the head is of convex form, and possesses in the middle line the spiracle or 'blowhole,' formed of the united nostrils, and presenting a crescentic shape. The eyes are of small size, and are situated low down on the head, and behind the posterior edge of the mouth or 'gape.' The ear opens close behind the eye, and is of very small size. The genital apertures of the male are placed much anterior to the anus or vent, the intervening space in the female being of smaller size, and containing the teats. As in all the Cetacea the tail or caudal fin is flattened, and placed horizontally or across the body, instead of vertically, as in fishes. The muscles and tissues beneath the skin are invested by a thick layer of blubber and fat. The bones are spongy in texture, and those of the limbs possess no medullary or marrow cavities. The neck, as in other Cetacea, is very short, and its vertebrae are ossified together, the lumbar part of the spine being elongated. The dorsal and lumbar vertebrae together number twenty-eight, the anterior fifteen of these belonging to the back, properly speaking. The skull has a 'flask-like' shape or contour, the jaws being prolonged. The fore limbs naturally project from the body, their flat surfaces being directed upwards and downwards. Six or seven bones exist in the wrist, and the five fingers, commencing with the thumb in order, possess respectively 2, 8, 6, 3, and 2 'phalanges' (which see) or separate bones. Nails are wholly wanting. The pelvic or haunch bones are represented by simple curved bony pieces, which lie imbedded among the muscles and tissues of the abdominal surface of the body. No hind limbs are developed. The teeth are of small size, and are not preceded by milk teeth, their crowns being of blunted shape. The stomach consists of three portions, into the first of which the gullet opens. No caecum exists, and a gall-bladder is wanting. The spiracle or outer nostril opens into a spiracular chamber, which in turn communicates with the external openings in the skull of the nostrils. These latter openings can be closed at will by valves. The 'blowing' of the Porpoise is caused by the ejection of the air, which has been used in breathing, from the outer spiracle; this air commonly lifting up with it such water as lies above the head and nostrils of the animal before it comes to the surface. Hence the water 'blown' by the Whales and porpoises does not consist, as commonly supposed, of water taken into the mouth and then ejected by the nostrils. By the muscular approximation of the epiglottis and upper part of the windpipe to the soft palate and hinder or mouth openings of the nostrils, the air-passages and nostrils are brought to form one continuous tube, and breathing can thus be performed independently of the swallowing of food or of the opening of the mouth. No olfactory nerves or those of smell exist, and the eye possesses a thick sclerotic or outer coat. The lungs are not divided into lobes, and the lung-tissue itself is of very dense structure. Vocal cords are undeveloped in the Porpoises.

The food of the Porpoises consists of herrings and other fishes, amongst shoals of which they prove very destructive. They commonly follow the herring-shoals, and frequently become stranded in the pursuit of their prey into shallow waters. They gambol in the water after the fashion of the Dolphins, and appear to exist in herds or 'schools.'

PORPORA, Niccolò (called by the Italians the *patriarch of harmony*), was born at Naples about 1685, and studied under Scarlatti, whose favourite pupil he was. His first opera, *Ariana e Teseo*, was brought out at Vienna, 1717. In 1722 he had composed five operas and an oratorio. The Saxon musician Hasse, who was his pupil for some time, transferred himself to Scarlatti, which caused enmity between these two musicians. In 1725 Porpora went to Vienna along with his celebrated pupil Farinelli; but while the success of the singer was complete, the composer from his too flowery style failed to please the emperor, and discontented with his reception returned to Naples. After professional visits to Rome and Venice he yielded to a pressing invitation from the court at Dresden. He had already composed fifty operas, and was regarded as without a rival. At Dresden an envenomed war of jealousy set in between him and Hasse, who had hitherto reigned supreme there. The victory finally remained with Porpora, who was soon called to encounter a more formidable rival. In 1729 a party in London, which was discontented with Handel, opened a second opera-house, and called Porpora to take the direction of it. Porpora, supported by Farinelli and other distinguished singers whom he had trained, again triumphed, and Handel after a heavy pecuniary loss gave up the theatre, and devoted himself to oratorio. Porpora now gave up his engagements in Dresden, and established himself in London. Here his reputation, especially as a singing-master, continued to be great; but from home-sickness or some other reason unknown he left London, and in 1738 is found at Venice, where he appears to have remained till 1745. One of his pupils, who was the mistress of the ambassador appointed by the republic to Vienna, took him with her to the Austrian capital. Here, in 1754, Haydn, for the sake of obtaining his instructions, became his valet. In 1760 he presided at the production in Naples of his last and feeblest opera, *Il Trionfo di Camillo*. His fame had long been declining, and although he had trained, besides Cafarelli and Farinelli, many more of the leading singers of the day, whose talents brought them large revenue, he was left to die in great poverty. Only a few of his operas are now known, and none of them have retained popularity; but he is regarded as the most accomplished singing-master who has ever existed. His religious compositions, and especially his cantatas, are the works in which he exhibits himself to most advantage. He died at Naples in 1767.

PORSENNA, or **PORSENA**, LARS, the king of the Etrurian city Clusium, according to the legend narrated by Livy, received the Tarquins when they were expelled from Rome, and after in vain endeavouring to effect their restoration by negotiation, advanced with an army to Rome. He would have entered the city with the flying Romans had not Horatius Coclès disputed the passage until the bridge was broken down. Porsenna then besieged Rome, and a famine was produced in the city, when another Roman youth, Mucius Scaevola, gave a striking proof of his patriotism and devotedness. (See **MUCIUS SCAEVOLA**.) Porsenna was now inclined to negotiation. He demanded that their property should be restored to the Tarquins, and that the cities taken from the Volentes in former wars should be given up. The second condition was granted; the first was rejected. A truce, however, was agreed upon, for the security of which the Romans sent ten young men, and as many girls, as hostages to the Etrurian camp. The latter found an opportunity of escaping to Rome by swimming over the Tiber. But the consul Publilius conveyed them back again to Porsenna, and was on this occasion treated with the

greatest indignity by the Tarquins. Porsenna on receiving intelligence of it immediately despatched his son Aruns to protect the Romans. Indignant at the perfidy of the Tarquins, and respecting the magnanimity of the Romans, the king separated himself from the former, and concluded peace with the latter without taking away their hostages. To relieve the wants of the Romans without offending their pride by a formal present, he left behind at his departure his whole camp with all its stores. In remembrance of his magnanimity the senate erected to him a monument, and presented him with an ivory chair and sceptre, a golden crown, and a royal robe. A subsequent proposition from Porsenna to the Romans to admit the Tarquins being declined, Porsenna abandoned them, lived in undisturbed friendship with the Romans, and restored to them the territory of the Volentes, which they had ceded at the conclusion of peace. Modern critics have held that Rome was completely conquered by Porsenna, and that the gifts they are represented as offering from gratitude were really a tribute indicating subjection. Aruns, the son of Porsenna, was defeated by a league of the Latin cities, after which the Romans are believed to have recovered their independence. The critics who give this interpretation to the legend do not accept the motive assigned to Porsenna of restoring the Tarquins. K. O. Müller, indeed, supposes that it was Porsenna, and not the Romans, who expelled them. According to Pliny Porsenna forbade the Romans the use of iron, except for agricultural purposes.

PORSON, RICHARD, a celebrated critic and classical scholar, professor of Greek in the University of Cambridge. He was born, December 25, 1759, at East Ruston, in Norfolk, where his father was clerk of the parish, and to him he was indebted for the first rudiments of his education. He received some further instruction at the village school, and also from the vicar of Ruston; after which he was sent to Eton, through the patronage of some gentlemen who witnessed and admired his early proficiency and inclination for the study of classical literature. In 1777 he became a student of Trinity College, Cambridge, where he gained a prize medal, and in 1781 he was chosen to a fellowship. He took the degree of M.A. in 1785, and not choosing to take holy orders, on account of conscientious scruples in regard to the signing of the Thirty-nine Articles, he was obliged to relinquish his fellowship. In 1792 he was unanimously elected Greek professor, and two years after he began the publication of the *Tragedies of Euripides*, with annotations, but continued his labours only through four of these dramas—*Hecuba*, *Orestes*, *Phœnissæ*, and *Medea*. He also assisted in editing the *Grenville Homer*, published at Oxford (1800, four vols. 4to), and corrected the text of the *tragedies of Æschylus* for a splendid edition, which issued from the Glasgow press in folio, also printed in two vols. 8vo. He enjoyed the reputation of being one of the best Greek scholars and critics of the age, notwithstanding which he experienced little patronage, a circumstance partly attributable to his intemperate habits. In 1805 he was appointed librarian to the London Institution, with a salary of £200 a year, and his death took place September 25, 1808, at his apartments in the house then belonging to that establishment in the Old Jewry. His decease was occasioned by apoplexy; and his body having been subjected to anatomical examination, it was discovered that his skull was one of the thickest that had ever been observed. He was the author of *Letters to Archdeacon Travis*, in Answer to his *Defence of the Three Heavenly Witnesses* (1790, 8vo), in which he is allowed to have proved that the received text of 1 John v. 7, 8 is

spurious; and after his death Professor Monk and C. J. Blomfield, afterwards Bishop of London, published his *Adversaria*, or Notes and Emendations of the Greek Poets; and his *Tracts and Miscellanies* were edited by the Rev. Thomas Kidd (1815). Many of these are sallies of irony and humour of the most racy and peculiar kind, which, with other articles abounding with learning and critical acumen, appeared in various of the literary journals. Acuteness of discernment, solidity of judgment, united to intense application and a stupendous memory, rendered Professor Porson a complete critic in the most honourable sense of that appellation.

PORT. The name of *Port wines*, or *Oporto wines*, is given, in commerce, to the produce of the vineyards along part of the course of the Douro, in Portugal, the district in which they are produced being a rugged and mountainous tract that begins about 60 miles above Oporto, and extends for 30 or 40 miles with an extreme breadth of about 12 miles. The wine district is now connected with Oporto by railway. Port is naturally a very rich and delicate wine, varying in colour from a pale rose to a deep red. It owes its special character partly to the soil of the district where it is grown, partly to the climate, which is cold in winter and very hot in summer. The harvest lasts from the beginning of September to the middle of October. The wines for export are very much mixed, and are strongly fortified with brandy, partly to make them sooner ready for export, and partly to suit the taste of the foreign markets, particularly England; but of late years brandied wines have been rather declining in popularity there. The mixing of the various wines considerably reduces the variety of qualities of port exported, compared with those which are naturally produced. A mixture called *jeropiga*, consisting of elder-berries, molasses, and raisin juice, is added with the spirit, especially to the lower qualities of the wine, to give the uniformity of colour which is deemed desirable. The wine is first placed in large tuns, in which it remains till spring, when it is racked into casks and conveyed to Oporto. To that intended for exportation brandy is added when it is deposited in the stores, and an additional quantity when it is shipped, generally about a year after the vintage. Port wines of excellent quality are often so highly adulterated with brandy as to be entirely deprived of their flavour and aroma; and the stronger kinds, which are not irretrievably ruined by this admixture, only regain their flavour after being allowed to mellow for many years. When the colouring and extractive matter is deposited with age and forms a crust, the colour of port becomes a deep tawny brown. The English market has always been the principal market for port wine. English connoisseurs have tended more than anything else to spread its fame in other countries. The taste for this wine was introduced into England in the seventeenth century, and English establishments were formed in Oporto to direct the purchase and shipping of the wines. These companies eventually united into a sort of corporation called the English Factory, which became completely master of the market. In the following century (1756) the Marquis of Pombal organized an association of producers to oppose this monopoly of buyers, and the company then established imposed restrictions on the trade which were not finally abolished till 1853, a new company having latterly taken the place of the old. In recent times the vines have suffered rather severely both from the oidium and from the more serious plague of the phylloxera.

PORT, in nautical language, the name given to the left side of the ship (looking towards the prow),

the port side being opposed to the starboard side. The order to *port the helm* means to steer so as to turn the rudder to the starboard side of the stern-post.

PORT ADELAIDE, a seaport of S. Australia, the port of the city of Adelaide, with which it is connected by a railway of 7½ miles. It is on the estuary of the Torrens, which enters the Gulf of St. Vincent, and is the chief port of S. Australia. The harbour accommodation has been recently greatly improved, extensive wharves, piers, &c., have been provided, but the entrance is still partly obstructed by bars. The town has a custom-house, marine board offices, court-house, &c. Pop. 5279.

PORTADOWN, a market-town of Ireland, in the county and 9 miles north-east of Armagh, on the Bann, here crossed by a bridge. Its principal buildings are the railway-station, and several places of worship. It has corn-mills, weaving and hem-stitching factories, spinning mill, underclothing factory, saw-mills, foundry, jam factory, pork-curing works, &c., and a trade in corn, pork, butter, and general farm produce. The Bann, which enters Lough Neagh 7½ miles below the town, and is also connected with the Newry Canal, is navigable for small vessels. Pop. (1891), 8430.

PORTAGE, a break in a chain of water communication, over which goods, boats, &c., have to be carried, as from one lake or river to another; or, along the banks of rivers, round waterfalls, rapids, &c.

PORTAGE LA PRAIRIE, a rising town of Canada, in Manitoba, on the Assiniboine, in a rich wheat-growing region. Pop. (1901), 3901.

PORTAL CIRCULATION, the distribution of venous blood collected from the spleen, stomach, intestines, and mesentery, throughout the liver by the *portal vein*. This peculiar circulation is distinctly and exclusively characteristic of vertebrate animals, no invertebrate possessing a circulation of this kind. The blood thus sent by the portal vein to the liver constitutes a secondary distribution of blood to that organ, the primary distribution being one of pure or arterial blood conveyed to the organ by the hepatic artery, and distributed to the connective tissue of the liver. The portal blood supplied to the liver constitutes the chief source from which that organ by means of its peculiar structure secretes the *bile*. (See **LIVER**.) The portal vein branches out and distributes itself in the liver much after the fashion of an artery, as described in the article **LIVER**. The branches of the portal vein are peculiar in that they are unprovided with valves, and the blood of the portal vein is finally returned into the *inferior vena cava*. The portal blood derived from the stomach, spleen, &c., contains more water and albumen and fewer red corpuscles than ordinary blood.

PORTARLINGTON, a market town of Ireland, partly in King's and partly in Queen's County, on the Barrow, 44 miles w.s.w. from Dublin. A colony of French and Flemish Protestants was formerly planted there, and many of their descendants still survive. It was named after the Earl of Arlington in the time of Charles II., and was a parl. bor. up to 1885. Pop. (1891), 2021.

PORT ARTHUR, a town and harbour at the north-western extremity of Lake Superior, Ontario, Canada, and a station on the Canadian Pacific Railway. Mining and lumbering are the chief industries. Pop. (1891), 2698; (1901), 3214.

PORT-AU-PRINCE, capital of the Republic of Hayti, on the western side of the island, on a bay of the same name. It is built in a low and unhealthy spot, with broad but unpaved and dirty streets, consists chiefly of wooden houses of two stories, and contains an ungainly palace, a senate-house, a handsome Roman Catholic church, a custom-house, mint, an

hospital, public offices, &c. The educational institutions are a lyceum, and several other schools. The shipping trade is considerable, the chief exports being mahogany and red wood, coffee, and cocoa-nuts. The trade is chiefly with North America, England, and France. The city was founded in 1745, and was completely destroyed by an earthquake in 1770. It has also several times been ravaged by fires, as in 1791, 1843, and 1867. Pop. estimated at 35,000.

PORTCULLIS, in fortification, is an assemblage of several large pieces of wood, joined across one another like a harrow, and each pointed with iron at the bottom. They are sometimes hung over the gateway of old fortified towns, ready to be let down in case of surprise, when the gates cannot be shut.

PORTE, **OTTOMAN**, or **SUBLIME PORTE**, the common term for the Turkish government, which has entered the English language through the French, and is derived from the oriental custom of holding court at the gate of the palace, or at the gate of a city.

PORT-ELIZABETH, a seaport town of Cape Colony, on the west side of Algoa Bay, about 420 miles east of Cape Town. It has many fine buildings, including a fine Episcopalian church, a handsome town-hall, custom-house, hospital, &c. It is the great centre of trade for the eastern portion of the colony as well as for a large part of the interior, being the terminus of railways that connect it with Kimberley and other important inland towns. The exports and imports together amount to over eight millions sterling. There is a sea-wall, and also two iron jetties, but the shipping is much exposed and a proper harbour is greatly wanted. Pop. by census of 1875, 13,049; by that of 1891, 23,052.

PORTER. See **BREWING**.

PORTER, the name of two talented sisters, of which, however, the elder, **JANE**, was the most distinguished. They were sisters of the celebrated traveller Sir Robert Ker Porter, and were natives of Durham. Jane Porter was born in 1776, and made her first essay in literature in 1803, by the publication of *Thaddeus of Warsaw*, a historical romance, which became extremely popular, and procured her admission as a canoness into the Teutonic order of St. Joachim, and a complimentary letter from Kosciusko. A still greater success attended her *Scottish Chiefs*, which appeared in 1809. A succeeding generation, however, has not confirmed the verdict of their fathers on this work, as though well and vigorously written in point of description and character, it gives a very erroneous representation of the condition of the country at the time. Her subsequent works were the *Pastor's Fireside*; *Duke Christian of Luneburg*; *Tales Round a Winter's Hearth*, in which her sister, Anna Maria, took a part; the *Field of Forty Footsteps*, founded on a London legend; and *Sir Edward Seaward's Diary*, published anonymously in 1831. In the last she imitated so closely the style and manners of the period, that for some time it was doubted whether it was a fiction or not. She died at Bristol in 1850.

ANNA MARIA PORTER was born in 1780, shortly after the death of her father; and before she was fifteen, published two volumes entitled *Artless Tales*, a proceeding, however, which she afterwards regretted. The greater part of her life was spent with her mother and sister Jane in the neighbourhood of London. She contributed extensively to various periodicals, and produced numerous novels, which enjoyed considerable popularity in their day. They include *The Hungarian Brothers*, *Don Sebastian*, *The Recluse of Norway*, *The Fast of St. Magdalen*, and *The Knight of St. John*. She is also the author of *Tales of Pity*, and a volume of poetry entitled *Balad Romances and other Poems*. She died near Bristol on Sept. 21, 1832.

PORTER, GEORGE RICHARDSON, an eminent statist, was born in London in 1792, and educated in the Merchant Tailors' School. He followed his father's profession, that of a sugar merchant, but was unsuccessful in business. He resolved to turn the knowledge which he had acquired of commercial matters to account in a literary point of view, and he accordingly published in 1830 a *Treatise on the Cultivation of the Sugar-cane*. Subsequently to this he wrote a *Treatise on the Silk Manufacture*, and another on the *Manufacture of Porcelain and Glass*, for Lardner's *Cabinet Cyclopædia*. A paper on *Life Assurance*, contributed by him to the *Companion to the Almanac* for 1831, obtained for him, through Mr. Knight, an appointment in connection with the board of trade. The duties of the office consisted in arranging and condensing into a compendious form the huge array of detached facts and statements contained in the blue-books and parliamentary returns. These were so satisfactorily executed by Mr. Porter, that on the statistical department of the board of trade being organized, he was placed at its head; and in 1841 was made one of the secretaries of the board, with a salary of £1500 a year. His great work is the *Progress of the Nation in its Social and Commercial Relations from the Commencement of the Nineteenth Century to the Present Time*, first published in 1836-38 (new edition, three vols., crown 8vo, 1847). He took a prominent part in the establishment of the *Statistical Society*, and also as a member of the *British Association for the Advancement of Science*. In 1850 he produced, in connection with Mr. Long, the *Geography of Great Britain*, part I., *England and Wales*, issued by the Society for the Diffusion of Useful Knowledge. His sedentary life, however, injured his health, and induced a bad habit of body. The sting of a gnaw on his leg gave rise to an inflammation which terminated his existence at Tunbridge Wells, on 3d September, 1852.

PORTER, SIR ROBERT KER, an eminent artist and traveller, was born at Durham in 1777, the son of an army surgeon. Jane and Anna Maria Porter were his sisters. He early showed uncommon genius for drawing, many of his sketches, made when he was only six years of age, being remarkable for their spirit; and in 1790 he became a student at the Royal Academy, under the auspices of Benjamin West. Not more than two years had elapsed since his commencing his studies at the Academy, when he was employed to paint the figures of Moses and Aaron for the communion-table of Shoreditch Church. In 1794 he presented to the Roman Catholic chapel at Portsea an altar-piece representing Christ calming the storm; and in 1798 he gave to St. John's College, Cambridge, an altar-piece, the subject of which is St. John preaching in the wilderness. He was only twenty-two when he began his large picture of the storming of Seringapatam. Though it contained nearly 700 figures as large as life, it was finished in ten weeks; nor did it bear any marks of haste, it being, both in composition and colouring, a work of high merit. It was succeeded by two other pictures of the same magnitude—the *Siege of Acre* and the *Battle of Agincourt*. In 1804 he was invited to Russia by the emperor, who made him his historical painter. He consequently visited St. Petersburg, where he was received with distinction, and employed to decorate the admiralty hall in the Russian capital. While residing there he gained the affections of the Princess Sherbatoff, and was on the point of marrying her when a rupture with Britain obliged him to leave Russia. He passed into Sweden to join the British forces under Sir John Moore, whom he accompanied to Spain, sharing in the hardships and perils of the

campaign, which ended with the battle of Corunna. After having remained for some time in Britain he again went to Russia, and received the hand of the Princess Sherbatoff. With her he revisited his native country, where, in 1813, he obtained the honour of knighthood. From 1817 to 1820 inclusive he was engaged in travelling through the East. In 1832 he was created a knight of Hanover. Being for some years British consul to Venezuela he resided at Caracas till 1841, when he paid a visit to St. Petersburg. Here he died, May 4, 1842, aged 61. Among his works are *Travelling Sketches in Russia and Sweden* (two vols. 4to, 1808); *Letters from Portugal and Spain* (8vo, 1809); *Narrative of the Campaign in Russia* (1813); *Travels in Georgia, Persia, and Armenia* (1822).

PORT-FIRE, a roll of combustible composition, generally burning an inch a minute, formerly used to fire the priming of ordnance. For this purpose it has long been superseded by other arrangements. With a slightly altered composition it is used for signals, and for firing charges of mines.

PORT-GLASGOW, a seaport town of Scotland, in Renfrewshire, on the southern bank of the estuary of the Clyde, 20 miles W.N.W. from Glasgow, and about 2½ farther up than Greenock. It is built on a regular plan, the streets crossing each other at right angles. The town-house, court-house, and prison combined form a fine range of buildings, with a Doric portico and a handsome spire. There are two parish and nine other churches, a public hall, a library, baths, and wash-houses, and a public park. In 1662 the magistrates of Glasgow purchased here 13 acres of land on which they built harbours and the first dry dock in Scotland. The place was intended to be the seaport of Glasgow and long did a large shipping trade; but when the Clyde was deepened so as to enable large vessels to sail up to Glasgow, the trade rapidly diminished. It somewhat revived several years ago. The staple industries are ship-building and marine engineering; and there are manufactories of sail-cloth, ropes, &c., iron and brass foundries, bolt and rivet works, &c. The harbour accommodation is fairly extensive, and there are large timber-ponds. The burgh joins with Kilmarnock, Rutherglen, Dumbarton, and Renfrew in sending a member to Parliament. Pop. in 1881, 13,264; in 1891, 14,624; in 1901, 16,840.

PORT HAMILTON, a large and commodious harbour formed by three small islands about 40 miles south of Corea, commanding the Straits of Corea leading from the Chinese to the Japanese Sea. It was selected as a British coaling station in 1885, but was soon given up.

PORT HOPE, a town of Canada, on the northern shore of Lake Ontario, 63 miles north-east of Toronto by the Grand Trunk Railway. It is beautifully situated at the base and on the declivity of the hills overlooking the lake, has a good harbour, active industries, and a considerable trade in timber, grain, and flour. Pop. (1901), 4188.

PORT HURON, a town and port of the United States, in Michigan, on the river St. Clair where it leaves Lake Huron, opposite Sarnia in Canada, with which there is now direct railway communication by a tunnel under the river. It has a large and increasing trade, especially in lumber, ship-yards, docks, grain-elevators, saw, flour, and planing mills, machine-shops, railway workshops, &c. Pop. (1890), 13,543.

PORTICI, a town in Southern Italy, extending along the Gulf of Naples at the base of Vesuvius. It is distant 5 miles from the city of Naples, but forms really a suburb of that city, being connected to it by the intervening village of S. Giovanni a Teduccio, while on the other side are the ruins of

Herculaneum, overlooked by the town of Resina. It is delightfully situated, has many elegant villas, and is surrounded by fine country seats. It possesses a royal palace, now belonging to the municipality of Naples. Pop. 12,500.

PORTICO, in architecture, a kind of porch inclosed by columns at the entrance of a building, and either projecting in front of the building or receding within it.

PORTISHEAD, familiarly 'Possett', a small town of England, in Somersetshire, on the Severn estuary, 10 miles from Bristol, now a favourite watering-place. There is an extensive dock in which vessels may load and unload instead of ascending the Avon to Bristol. Pop. (1891), 2500; (1901), 2544.

PORTIUNCULA. See **FIANCISCANS**.

PORT JACKSON. See **SYDNEY**.

PORT JERVAIS, a town of the United States, in Orange co., New York, beautifully situated at the confluence of the Neversink and Delaware, where the boundaries of New York, New Jersey, and Delaware meet. It carries on various important manufactures. Pop. (1890), 9327.

PORTLAND, a seaport town in the United States of America, in Maine, 100 miles N.N.E. of Boston, on a peninsula at the western extremity of Casco Bay, at the southern extremity of the Atlantic and St. Lawrence Railway. The ground, rising into two heights at its eastern and western extremities, forms a natural amphitheatre, and gives to the town, which is built upon it, more especially when it is approached from the sea, a beautiful appearance. It is laid out with considerable regularity, at least in the more modern portions; and the main street, extending along the ridge of the peninsula east to west, is not surpassed by many in the Union. Among the buildings are the court-house, the city hall, the custom-house, post-office, and court-rooms; the Athenæum, and the Mechanics' Hall. The largest manufacturing establishment is a factory in which locomotives, cars, &c., are made; there are also ship-building yards, glass-works, potteries, and rope-walks; and the refining of petroleum and sugar is extensively carried on. The trade is extensive. The harbour is of easy access, capacious, safe, deep enough for the largest vessels, and rarely obstructed with ice; hence it is a seat of winter traffic between Britain and Canada. There are dry docks and other facilities for the repair of vessels. The greater part of the carrying trade to and from foreign parts is in British ships. The coasting trade is extensive, and many vessels are engaged in the fisheries. The principal exports are timber, fish, beef, butter, &c. Portland was settled in 1632, but was nearly destroyed by the Indians in 1675. It suffered severely during the revolutionary war from a bombardment by the British fleet in 1775. The city is considered remarkably healthy, and in its vicinity there are many fine seaside summer resorts. Pop. in 1880, 33,810; in 1890, 36,425; in 1900, 50,145.

PORTLAND, the chief city of Oregon, United States, situated on the left bank of the river Willamette, about 12 miles from its confluence with the Columbia. The city is the terminus of the Northern Pacific Railway system, and is at the head of ship navigation, having regular steam communication with British Columbia and San Francisco. Among its public buildings are a court-house, city-hall, custom-house, churches, academies, library, high-class and common schools, lunatic asylum, &c. There are also iron-foundries, machine-shops, flour-mills, breweries, canneries (for salmon), and other establishments. Wheat, oats, flour, wool, and lumber are exported. Pop. (1880), 17,577; (1890), 46,385; (1900), 90,426.

PORTLAND, ISLE OF, a peninsula supposed to have been formerly an island, in the south of England, county of Dorset, 50 miles w.s.w. of Southampton, in the British Channel, forming the western boundary of Weymouth Bay. It is attached to the mainland by a ridge of shingle, called the Chesil Bank, about 10 miles long. It consists of nearly one mass of limestone, called Portland stone (which see), and is about 4 miles long by 1½ mile broad, terminating on the south in Portland Bill. The peninsula is almost completely surrounded by high, inaccessible cliffs. Fish abound along the coast, particularly mackerel. One of the most prominent objects in the Isle is the convict prison, situated on the top of a hill. The convicts are chiefly employed in working the quarries. There are several villages or hamlets on the Isle, a castle built by Henry VIII. and another attributed to William Rufus; and at Portland Bill are two lighthouses. Mention should also be made of the Verne fortress, hewn out of the rock, and the great breakwater (see next article) at the north-east end, forming a fine harbour of refuge, now used as a naval station. Another breakwater is being constructed on the Weymouth side. Pop. (1901), 15,262.

PORTLAND BREAKWATER, the greatest work of the kind in Britain, runs from the east side of the Isle of Portland (see above) in a north-east direction, with a bend towards the Channel, and forms a complete protection to an extent of 8745 acres of water—namely, 2107 acres from low-water up to a depth of 12 feet, 1758 between 12 and 19 feet, 1590 between 3 and 5 fathoms, and 1290 outside the 5-fathom line. The breakwater is built in 9 to 10 fathoms of water. It is founded on rubble stones, surmounted by an ashlar superstructure with a parapet. It consists of a sea-wall 100 feet high from the bottom of the sea, 300 feet thick at the base, and narrowing to the summit. Its entire length is 1½ mile, and it is in two portions, there being an inner breakwater 1900 feet in length, starting from the shore, and an outer of 6200 feet in length, forming an obtuse angle with the other portion, and divided from it by an opening 400 feet wide, through which ships can pass. It is protected by a circular fort at the north end 100 feet in height, 400 feet in diameter at the base, and 200 at the summit, standing in a depth of 60 to 70 feet of sea-water. The lower story is reserved for stores; in the upper one are mounted some very powerful guns. There is also a circular fort at the east end of the inner breakwater, carrying heavy guns, and on the Isle of Portland itself is another strong fort called Fort Victoria. The inner breakwater has a roadway with arched recesses in which stores are lodged. The entire work occupied a period of nearly twenty-five years, and cost £1,033,600, exclusive of convict labour to the value of probably £400,000. It is constructed of stone quarried by the convicts in the Isle of Portland. The first idea of the breakwater is due to John Harvey, postmaster, Weymouth, who urged it upon the admiralty in 1794. The preliminary works were begun in August, 1847, with Rendell as engineer-in-chief. On his death in 1856 he was succeeded by Mr. (afterwards Sir John) Coode, who had hitherto acted as resident engineer. The first stone was lowered into the sea on a signal from Prince Albert, 25th July, 1849; the last stone was laid by the Prince of Wales, 10th August, 1872. The work was begun under the superintendence of the board of trade, and finished under that of the admiralty.

PORTLAND CEMENT, a cement so called from its resemblance in colour to Portland stone. It is made from chalk and river mud or a suitable clay, mixed in definite proportions. The materials are intimately mixed with water and formed into a

sludge. This is dried, and when caked is roasted in a kiln till it becomes hard. It is afterwards ground to a fine powder, in which state it is ready for the market. It is much employed along with gravel or shivers in making artificial stone. A month after it is set it forms a substance so hard as to ring when struck. See CEMENTS.

PORTLAND STONE is an oolitic limestone occurring in great abundance in the Isle of Portland in Dorsetshire (see above), and largely quarried for building purposes. It has been used in considerable quantity in the metropolis since the seventeenth century, St. Paul's cathedral having been built of it. The finest stone is found in the lowest strata. The strata are rich in fossils.

PORTLAND (or BARBERINI) VASE. This beautiful specimen of Greek art is a cinerary urn found in a marble sarcophagus at Monte del Grano, near Rome, during the pontificate of Urban VIII. (1622–44). It is formed of glass of a dark-blue colour, and is ornamented with relieved figures in white enamel. It is 10 inches high, 7 in diameter at the broadest part, and is furnished with a handle on each side. It was placed in the Barberini Palace, where it remained till 1770, when it was purchased by Sir William Hamilton, from whose possession it passed into that of the Duchess of Portland. In 1810 the Duke of Portland gave it on loan to the British Museum, of which he was a trustee. In 1845 a stupidly malicious fellow, or more probably a lunatic, who had been admitted to the museum as a visitor, deliberately smashed it with a stone. It was skilfully repaired, however, and is exhibited to visitors.

PORTLAW, a village in Ireland, county of Waterford, 9 miles w.n.w. of the town of Waterford, on the Clodagh. It has several places of worship, and had formerly an extensive cotton-factory. Pop. (1891), 1394.

PORT-LOUIS, the capital of the island of Mauritius, on the north-west coast, beautifully situated in a cove formed by a series of basaltic hills, portions of which are woody; they vary in height from 1058 to 2639 feet. The streets are rather narrow; they are laid out at right angles, with basaltic curbstones, and are adorned with magnificent acacias. A mountain stream traverses the town, and an open space like a race-course, called the Champ de Mars, lies behind it, and is bordered by elegant villas. There are barracks, bazaar, theatre, public library, botanic garden, and an hospital. The town and harbour are protected by batteries. Port-Louis is a coaling station of the British navy. The harbour accommodation includes three graving-docks. Immense damage and loss of life were caused by a hurricane in April, 1892. Pop. in 1891, 62,046.

PORT-MAHON. See MAHON.

PORT-NATAL, the port or bay on the coast of the colony of Natal, which has on its shore the port-town of Durban. See DURBAN.

PORTO-ALEGRE, a town in Brazil, capital of the state of Rio Grande do Sul, near the north-west extremity of Lake Patos. It is well and regularly built, but only the principal streets are paved. It has several elegant churches, a custom-house, hospital, lyceum, &c.; a harbour much visited by merchant vessels, and an important trade. Pop. 100,000.

PORTOBELLO, a parliamentary burgh of Scotland, in the county and 3 miles east of the city of Edinburgh, on the Firth of Forth, connected with Edinburgh by railway and tramway. Among the ecclesiastical buildings the finest are two churches of the United Free Church of Scotland. There are a neat public hall and fine municipal buildings in the Scottish baronial style, erected in 1878 at a cost of £7000. It has extensive potteries, brick and tile

works, bottle-works, and a paper-mill. It is much frequented as a summer resort from all parts. The beach is well adapted for bathing, and in 1901 the Edinburgh corporation erected sea-water baths. The promenade is over a mile long, and the pier, built in 1871 at a cost of £10,000, is 1250 feet long and 22 feet broad. Portobello belongs to the Leith parl. district of burghs. It is united municipally with Edinburgh. Pop. (1891), 8181; (1901), 9180.

PORTO-BELLO, or **PUERTO-BELO**, a seaport of Colombia, on the Caribbean Sea, 40 miles N.N.W. of Panamá, founded in 1584, and at one time a place of importance. It was taken by Admiral Vernon in 1739, and is now almost deserted owing to its unhealthiness.

PORTO-CABELLO, or **PUERTO-CABELLO**, a town of Venezuela, on the Caribbean Sea. It is built partly on a small island which communicates with the continent by a bridge. It has a capacious and safe harbour, and a population of 7500.

PORT OF SPAIN, the chief town of the island of Trinidad. It is a pleasant, well-built town; has two cathedrals, government house, town-hall, court-house, theatre, military and police barracks, botanic gardens, public library, &c. It is a railway terminus, and has a good trade. Tramways and telephones have been introduced. Pop. (including suburbs), 55,000.

PORTO-MAURIZIO, a seaport town in Italy, province of Maurizio, 40 miles E.N.E. of Nice, on the south-western shore of the Gulf of Genoa. It is picturesquely situated, is frequented as a winter residence, and has a good harbour with a considerable trade, especially in olive-oil. Pop. 8000.

PORTONOVO, a seaport town of Hindustan, in Madras presidency, 145 miles south of Madras, formerly a large and wealthy town, but now with only about 14,000 inhabitants. In 1781 Sir Eyre Coote gained here a signal victory over Hyder Ali.

PORTO-RICO (Spanish, *Puerto Rico*), an island in the West Indies, the fourth in size of the Antilles, east of Hayti and west of the Virgin Islands; lat. (south-west point) 17° 56' N.; lon. 67° 10' W.; area, with small subordinate islands, 3596 square miles. A range of lofty mountains, covered with wood, runs through the island east to west, averaging about 1500 feet in height; its loftiest peak is 3678 feet high. In the interior are extensive savannahs, on which numerous herds depasture; and along the coast, tracts of level fertile land, varying in some places from 5 miles to 10 miles wide, but in others the mountains approach much closer to the sea. Nearly the whole of the north coast is lined with navigable lagoons, some of them 10 miles long, and many of the rivers can be navigated to the foot of the mountains, a distance of 5 or 6 miles. There are numerous bays and creeks, deep enough for vessels of considerable burden; but the north coast is subject to tremendous ground seas, which beat against the cliffs with great violence. Only certain harbours are safe all the year round, among them being that of the capital, San Juan, situated on the north coast. There are no serpents or other reptiles on the island; but numerous large rats often do great injury to the sugar-cane. The climate is generally more salubrious than that of the other islands of the Antilles. Gold is found in small quantities. Copper, iron, lead, and coal have also been found; and there are salines or salt ponds. Porto-Rico is almost wholly an agricultural island; its products being coffee, sugar, rum, molasses, excellent tobacco, hides, live stock, dye-woods, timber, bananas and other fruits, &c. In 1900-1901 the imports were valued at about £1,875,000, of which about £1,480,000 represented imports from the United States; and the exports were valued at

about £1,725,000, of which £1,180,000 went to the United States. The chief articles of export are coffee and sugar; and the principal imports are cottons, rice, and provisions. The capital of the island is San Juan de Porto-Rico. There are numerous other towns, the chief of them being Mayaguez and Ponce. Railways, telegraphs, and telephones have been introduced. The island was discovered by Columbus in 1493. It was invaded in 1509 by the Spaniards from Hayti, who exterminated the natives, estimated at 600,000 to 800,000 in number, in a few years. Slavery was abolished in 1873. Spain ceded Porto-Rico to the United States in Dec., 1898. It has a governor with a nominated council, and an elected legislative assembly. Pop. (1899), 953,243, about 300,000 being coloured.

PORTO-RICO, **SAN JUAN DE**, the principal city and seaport of the above island, on its north coast. It stands upon a small island connected with the mainland by a bridge, and is surrounded by strong fortifications. It is the seat of the government and superior courts of the island. The harbour is very spacious, and capable of accommodating ships of the largest size. Pop. (1899), 32,048.

PORTO SANTO, a small island about 40 miles north-east of the island of Madeira, of which it is a dependency. It is 6 miles long, 2½ broad, and produces wine, oranges and other fruits, vegetables, &c. It was for some time the place of residence of Columbus.

PORT-PATRICK, a village and seaport in Wigtownshire, Scotland, on the shore of the Irish Sea, forming the nearest port of Great Britain to Ireland, the distance here between the two islands being only 21 miles. The harbour was formerly small and inconvenient, being a mere inlet between projecting ridges of rock, but in 1821 an artificial harbour was begun, and was finished at a cost of £500,000. Steamboats, with the mail-bags and passengers, used to pass regularly between this port and Donaghadee, in Ireland, but this has been discontinued since 1849, and the place has sunk into insignificance. A submarine electric telegraph and telephone have been laid between the two places. Pop. (1891), 520; (1901), 451.

PORT-PHILLIP, Australia. See **VICTORIA**.

PORTREE, a village of Scotland, in the county of Inverness, on a small bay on the east shore of the island of Skye, opening into Raasay Sound. It is the chief place in Skye, and has a good harbour, which is regularly visited by Glasgow steamers. Pop. (1891), 1003; (1901), 872.

PORT-REPUBLICAIN. See **PORT-AU-PRINCE**.

PORT-ROYAL, a fortified town on the south-east coast of Jamaica, on the extremity of a tongue of land, forming the south side of the harbour of Kingston. Its harbour is the station for the British ships of war, and it contains the naval arsenal, hospital, &c. It has been often damaged by earthquakes. Pop. 1200.

PORT-ROYAL, a Cistercian convent in France, which played an important part in the Jansenist controversy. This celebrated convent was founded in 1204 by Matthieu de Montmorency. It was situated near Chevreuse (department of Seine-et-Oise), about 15 miles south-west of Paris. It was placed under the rule of St. Bernard. The original name of the site was Porrais or Porrois; this was transformed first into Port-du-roi, then into Port-Royal. Port-Royal, like many other religious houses, had declined from its original severity and fallen into very degenerate habits, when in 1609 the abbess Jacqueline-Marie-Angélique-Arnauld undertook its reform. The number of the nuns increased considerably under her rule, and in 1625 it amounted to

eighty. The building had become insufficient, and the insalubrity of the situation induced them to seek another site. The mother of the abbess undertook the charge of the translation. She purchased and presented to the nuns the house of Cluny, situated at the extremity of the Faubourg Saint Jacques in Paris, to which a body of the nuns at once removed. The old site was subsequently improved by drainage, and a new house built on a higher and healthier situation. The two sections of the convent thus divided were now distinguished as Port-Royal des Champs and Port-Royal de Paris. About 1636 a group of eminent literary men of decided religious tendencies, mostly the relatives of the abbess, took up their residence at a house called Les Granges, near Port-Royal des Champs, where they devoted themselves to religious exercises, manual and literary labours, the education of youth, and the preparation of educational works. These were regarded as forming a joint community with the nuns of Port-Royal, among whom most of them had relatives, and who in most matters followed their counsels. Among those who selected this retirement were Antoine Arnauld, Arnauld D'Andilly, Lemaître de Sacy and his two brothers, the first two being brothers, the last three nephews of the abbess; Nicole, and subsequently Pascal, whose sister Jacqueline was a nun of Port-Royal. These men founded here an eminent educational institution, which flourished till 1660, and became a powerful rival to the institution of the Jesuits, and as they adopted the views of Jansenius, which were subsequently condemned by the pope, a formidable quarrel ensued, in which the Port-Royalist nuns, siding with their male friends, became subject to the relentless persecution of the Jesuits, which culminated in the complete subversion of their institution. Port-Royal de Paris had, in the meantime, been growing rapidly in wealth and influence. It was patronized by many persons of high rank at the court, some of whom made it their last retreat and bequeathed their means to it. It was under the direction of the Abbé de Saint Cyran (Duvergier de Hauranne), whose hostility to the Jesuits led, during the last days of Richelieu, to his imprisonment in Fort St. Vincennes. During the wars of the Fronde the house in the country exercised a liberal hospitality. Its protection was much sought and its church was quite filled with cattle and stores deposited for safety, so that it was compared to Noah's ark. The history of the struggle in which the two convents of Port-Royal successively succumbed to their formidable foes is too long and too much involved in questions of ecclesiastical discipline and religious controversy to be dealt with here. It has been related in detail by Racine, the most distinguished pupil of the Port-Royalist educational seminary, in his *Histoire de Port-Royal*. The most remarkable incident in it was the miracle alleged to have been wrought upon the person of the niece of Pascal, and firmly believed in, not to mention others, by two such eminent men as Pascal and Racine. The object of this miracle, which was wrought by means of a thorn from the crown of our Saviour, was to demonstrate the innocence of the nuns of Port-Royal, who were accused by the Jesuits of contempt of the holy sacrament, an accusation the more grievous as these nuns were specially devoted to the worship of the holy sacrament. But this vindication was unavailing, the Jesuits were miracle-proof, and they succeeded in gaining the ear of the king. In 1664 Port-Royal de Paris was occupied by the police. The nuns, with the exception of a few who acceded to the terms of the Jesuits, and henceforth became the declared enemies of their former associates, were imprisoned for some months and then

sent to Port-Royal des Champs, which was put under military surveillance till 1669, the soldiers behaving with great licence and rudeness. In 1669 the two houses were permanently separated by royal authority. Port-Royal des Champs retained eighty nuns and two-thirds of the joint property, Port-Royal de Paris ten nuns and one-third, and was placed perpetually under the nomination of the king. The nuns of Port-Royal des Champs still persisted in refusing to sign the Papal edict condemning the doctrines of Jansenius, and on 29th October, 1709, the convent was finally suppressed by order of Cardinal Noailles, in execution of a bull of Pope Clement II. The nuns were dispersed in different convents, and their property given to Port-Royal de Paris. This convent continued in existence till the revolution, when its house was converted into a prison, and subsequently (1814) became the Maternity Hospital.

PORTRUSH, a small seaport in the north of Ireland, in Antrim, 5 miles north of Coleraine. It is much resorted to for sea-bathing; and trades with Londonderry, Liverpool, and Glasgow. It is connected with the Giant's Causeway by an electric tramway. Pop. (1891), 1655; (1901), 1942.

PORT SAID, a town of Egypt, on the Mediterranean, situated on one of those narrow belts of land which separate Lake Menzaleh from the Mediterranean, exactly at the terminus of the Suez Canal. It was begun simultaneously with the canal in 1859, being designed for its terminal port. The houses are built on the European type, with sloping roofs. There is here an outer harbour formed by two piers which jut out into the sea, each terminated by a lighthouse having a coloured light. The one to the east is 2070 yards in length, that to the west 2730. At the outer end their distance apart is 760 yards, at the inner 1530. They are formed of blocks of concrete, each 12 cubic yards in size and 22 tons in weight, made on the spot, of sand combined with hydraulic lime. The piers inclose an area of about 500 acres, which is dredged sufficiently deep for the accommodation of vessels of moderate size. The central portion is deepest, and admits large ocean steamers, which thus sail into the inner harbour and from it into the canal. Near the entrance to the inner harbour there is a very lofty lighthouse, formed of concrete and iron, and having a powerful light. This harbour is provided with quays, wharves, and other accommodation necessary for a large traffic. Port Said is called after Said Pasha, viceroy of Egypt from 1854 to 1863. The population, which is very varied in nationality, was 42,095 in 1897.

PORTSEA, an island of Hampshire, England, extending from north to south about 5 miles, and from east to west about 3. The island belongs to the Tertiary formation. It comprises the borough and seaport town of Portsmouth, the town of Portsea, and several villages. The land is flat, and the soil in general fertile. The coasts are defended by several detached forts and castles, the most important of which are Fort Cumberland, Southsea Castle, and Hillsea. It is connected with the mainland by a bridge at its north end. See **PORTSMOUTH**.

PORTSMOUTH, the principal station of the British navy, a seaport, municipal, parli., and county borough of England, in Hampshire, on the south-west extremity of the island of Portsea, and at the terminus of the London and South-Western and the London, Brighton, and South Coast Railways, 68 miles s.s.w. London; lat. (Royal Naval College) 50° 48' N.; lon. 1° 6' 15" S. It consists of the two towns of Portsmouth proper and Portsea, and of several suburbs, these being now more extensive than the towns to which they belong. Both towns, united together so as to form a fortress, were surrounded by

moats, walls, and ramparts, and entered by four gates, one of them designed by Inigo Jones. These defences having been rendered useless by the modern system of fortification, the ramparts have been pulled down, the gates removed, the creek and moats filled up, making a very large vacant space, of which two fine recreation grounds for military and naval officers and men have been formed, together with wide roads lined with trees. The work has been executed chiefly by soldiers and convicts. The ancient parishes of Portsmouth and Portsea, with the districts of Southsea, Landport, and Kingston, and the hamlets of Milton, Copner, and Hilsea, are all situated in the 'Island of Portsea,' which is separated from the mainland by a narrow creek called Portbridge Canal. The island of Portsea is bounded on the e. by Langston Harbour, on the w. by Portsmouth Harbour, and on the s. by the roadstead or channel of Spithead, across which is the Isle of Wight. The town of Gosport lies opposite Portsmouth on the other side of the entrance to Portsmouth harbour. The best street in Portsmouth is the High Street, which divides the town into two nearly equal parts, and contains the principal shops, hotels, and places of business. In its older parts Portsea presents a less attractive appearance than Portsmouth, but it has improved very rapidly in recent times, and has several good terraces, and one well-built open space called St. George's Square. The suburbs consist of Landport and Kingston adjacent to Portsea on the north, and of Southsea, on the east side of the town of Portsmouth. The two first-named districts are for the most part occupied by artisans connected with the royal naval dockyard (in Portsea). They contain, however, some handsome villas and rows of well-built houses. There is a fine park, the Victoria Park, in a conveniently central situation. Southsea is one of the favourite English sea-side resorts. Its situation commands fine views of the anchorage at Spithead, and of the Isle of Wight. Southsea common, which extends down to the beach, forms a fine public recreation ground, and on it troops from the neighbouring garrisons are often assembled for field-days and reviews. Southsea Castle with its adjacent earthworks, the batteries of the Gosport side, and the circular forts built out in the roadstead, command the entrance to Portsmouth Harbour.

Among the public buildings the most conspicuous are the parish church (St. Thomas à Becket's), built about 1170; the Roman Catholic Cathedral with schools adjacent; the Presbyterian Church; the Independent Chapel in King Street; and numerous other places of worship; the Government House; the splendid new town-hall opened in 1890; the post-office, the Grammar School, Athenæum, theatre, hospital, Sailors' Home, Central Railway Station, &c. The royal dockyard, which has recently been extended by the addition of new docks and basins, covers an area of about 500 acres, and is believed to be the largest and most magnificent establishment of the kind in the world. It is inclosed by a wall 14 feet high, and entered by a lofty gateway. It includes vast store-houses, containing all the materials requisite for naval architecture; machine-shops, with all modern appliances; extensive slips and docks, in which the largest ships of the navy are built or repaired; a smithy in which anchors are forged, block-making establishment, ranges of handsome residences for the port-admiral and other officials, &c. Outside the dockyard an area of 14 acres contains the gun-wharf, where vast numbers of guns and other ordnance stores are kept; and there is an armoury with 25,000 stand of small-arms.

Portsmouth has no manufactures of any consequence, except those immediately connected with its naval establishments, and a few large breweries. Its

trade, both coasting and foreign, is of considerable extent; the former consisting chiefly of coals from the Welsh and Newcastle coal-fields, cattle and sheep from the Isle of Wight and the west of England, and large quantities of corn and provisions from Ireland; and the latter of wine from different parts of the Continent, eggs from France, and timber from the Baltic. The number of vessels entered from foreign and colonial ports, with cargoes or in ballast, in 1900 was 332, tonnage 51,907; cleared 247, tonnage 24,949; in the coasting trade, entered 16,411, tonnage 1,799,686, cleared 16,305, tonnage 1,775,558. The total value of the exports abroad in 1900 was £121,022; of imports from abroad £222,174.

Portsmouth is mentioned in the Saxon Chronicle as existing in 501. It appears to have taken the place of Porchester, which had been selected by the Romans for a naval station, but became unfit for that purpose in consequence of the receding of the sea. During the reign of Alfred a fleet of nine ships fitted at the port signally defeated the Danes, who had long infested the coast; and immediately before the Conquest a large fleet was fitted out here to intercept the Norman armament. About 1256 Henry III. assembled an army here for the invasion of France. In 1377 Portsmouth was attacked by the French, who succeeded in burning a part of the town. This disaster appears to have shown the necessity of fortifying the place, and the works, commenced by Edward IV., were much improved and extended during succeeding reigns. Of late years an extensive and systematic series of fortifications has been under construction for its complete defence. They extend along a curve of about 1½ mile at the north side of Portsea Island, commanding the Portbridge Canal. A chain of hills, known as Portdown, situated about 4 miles to the north of Portsmouth, and running almost straight west to east, thus commanding its front to the sea, are well fortified with strong forts. On the Gosport side the works are similar, with a line of forts extending for 4 miles. The usual garrison consists of only three regiments of foot. The *Royal George* sunk in Portsmouth harbour in 1782, drowning nearly 1000 persons. The county and parliamentary borough includes nearly the whole of the Island of Portsea. It sends two members to the House of Commons. Pop. in 1881, 127,989; in 1891, 159,255; in 1901, 189,160.

PORTSMOUTH, a seaport town of the United States, in Rockingham county, New Hampshire, situated on a peninsula on the right bank of the Piscataqua, 3 miles above its mouth in the Atlantic, 50 miles north by east of Boston. Among the public edifices are the churches, an academy, an atheneum, with a library and good collections in natural history; an almshouse, two market-houses, and a state lunatic asylum. The chief industrial establishments are a machine-shop and car-factory, manufactures of hosiery and fine twist, and a large steam-factory for weaving the finer kinds of cotton fabrics. The harbour, the only one immediately connected with the sea which the state possesses, is one of the safest and most commodious in the United States. There is here a United States navy-yard. The town has long been noted for its skill in naval architecture and maritime enterprise. Pop. in 1880, 9690; in 1890, 9827.

PORTSMOUTH, a seaport town and port of entry in the United States, Norfolk county, Virginia, at the mouth of the Elizabeth, 88 miles e.s.e. Richmond; with a court-house, jail, several churches, a bank, a theatre, a military academy, and a harbour allowing ships of the heaviest burden to come to the wharfs. At Gosport, a suburb of Portsmouth, are a United States navy-yard, dry-dock, and naval hospital. Pop. (1880), 11,390; (1890), 13,268.

PORTSMOUTH, a town in the United States, capital of Scioto county, Ohio, 82 miles south of Columbus, on the Ohio, at the confluence of the Scioto; with a court-house, jail, several churches, the Ohio Military Academy, a public library, and extensive iron and other manufactures. Pop. (1880), 11,321; (1890), 12,394.

PORTUGAL (ancient *Lusitania*), a kingdom in the south-west of Europe, forming the west part of the Iberian Peninsula; lat. $36^{\circ} 55'$ to $42^{\circ} 7' N.$; lon. $6^{\circ} 15'$ to $9^{\circ} 30' W.$; bounded east and north by Spain, and west and south by the Atlantic; greatest length, north to south, 345 miles; greatest breadth, 140 miles. It is divided into seven provinces, of which the names, area, and population are exhibited in the following table, along with the Portuguese colonial possessions in Africa and Asia:—

Provinces.	Area, sq. miles.	Population, 1890.
Minho	2,807	1,173,106
Tras-os-Montes	4,291	429,170
Beira	9,244	1,518,406
Estremadura	6,872	1,232,598
Alentejo	9,416	413,531
Algarve	1,872	254,861
Total continent . . .	34,502	5,021,057
Azores	922	256,474
Madeira	813	150,528
	35,737	5,428,059

The corresponding population by census of 1890 was 5,049,729. The only two large towns in the kingdom are Lisbon, the capital, and Oporto, the chief port.

The colonial possessions of Portugal consist of—in Asia—Goa, Damão (Daman or Damaun), and Diu, all in Hindustan, Macao, and possessions in the Indian Archipelago, having together an area estimated at 7708 square miles, and a population estimated at 900,000; in Africa—Cape Verd, St. Thomas, and Prince's Islands, Bissagos, Guinea, Angola, and Portuguese East Africa, with an aggregate area of 820,686 square miles, and an estimated population of 14,000,000. A large part of the Portuguese possessions in Africa, however, are only nominally under their rule. As a people the Portuguese are small in stature, and are generally inferior to the Spanish in physical appearance.

Coasts and Surface.—Portugal is not separated from Spain, except on a small part of its frontier, by natural boundaries. Its shape is nearly that of a parallelogram. The coast-line, of great length in proportion to the extent of the whole surface, curves from the north in a s.s.w. direction, till it reaches Cabo da Roca, the most westerly point of the peninsula, and of continental Europe. Here it becomes somewhat irregular, forms two bays—that of Lisbon and that of Setubal—by the intersection of the remarkable promontory which terminates in Cape Espichel, and again curves round in a s.s.w. direction till it reaches Cape St. Vincent, where it suddenly turns east. This direction it retains to its termination at the mouth of the Guadiana. It is occasionally bold, and rises to a great height, particularly at Cabo da Roca, where it presents a range of giddy cliffs; but for the far greater part is low and marshy, and not unfrequently lined by sands and reefs, which make the navigation dangerous. It is not unprovided, however, with harbours. The number, large and small, is counted at twenty-one; but the only ones of importance, either from their excellence or the trade carried on at them, are those of Lisbon, Oporto, Setubal, Faro, Figueira, Aveiro, and Vianna. The interior is generally mountainous, a number of ranges stretching across the country, either in west, south-west, or south-south-west directions, forming a succession of independent river basins, while their

ramifications, penetrating in all directions, form the water-sheds of numerous subsidiary streams, and inclose many wild and beautiful valleys. The loftiest range of all is the Serra da Estrella, which may be considered as a continuation of the central chain which stretches across Spain between Old and New Castile, and between Leon and Estremadura. Near the town of Guarda it forms a sort of fork, one limb of which proceeds north, and another south-east while the main chain, running south-west, attains its culminating point of 6537 feet about 5 miles west of the town of Covilhão, and ultimately terminates in the lofty cliffs of Cabo da Roca. Nearly parallel to this chain, and at no great distance from it, are on the north the Serra de Alcoba, and on the south the Serra Moradal. In the north branches or continuations of the Spanish mountains enter Portugal and attain heights of 4740 feet in Peneda, and of 5180 in Larouco. At the opposite extremity the Serra Monchique, stretching across the country at a short distance behind the south shore, attains, at its western extremity in Mount Foia, the height of nearly 3000 feet. The rugged nature of the surface makes the plains both few in number and of limited extent, but many valleys equally remarkable for beauty and fertility occur. The chief plains are those of Almeida and the Terra de Braganza, the former in the province of Beira, and the latter in that of Tras-os-Montes; the chief valleys, those of Chaves, Villarica, and Besteiros.

Geology.—The nucleus of the mountains is usually granite, overlain in the north by micaceous schist and other metamorphic rocks. Crystalline rocks and Paleozoic formations (especially Silurian) occupy about two-thirds of the surface, but the Jurassic, the Cretaceous, and various Tertiary formations are also represented in the more southerly parts of the country. Volcanic formations are very apparent in the Serra de Caldeirão, forming a continuation of that of Monchique. The mineralogical treasures seem more remarkable for their variety than for their value, though some are, and many more, it is supposed, might be, worked to advantage. They include argentiferous lead, copper, iron, cobalt, bismuth, antimony, fine marble, slate, salt, saltpetre, lithographic stones, mill-stones, and porcelain earth. Some gold also is washed from the sands of the Douro, Mondego, and other streams, and in several serras, particularly those of Estrella and Gerez-Larouco; and many valuable pebbles and rock-crystals are found in a great number of places.

Rivers.—No rivers of importance take their rise in Portugal, and yet few countries in proportion to their extent are better supplied with large and navigable streams. The Minho in the north, forming the boundary between Spain and Portugal in the lower part of its course; the Douro, first skirting the east frontier, and then pursuing its course west to its mouth at Oporto; and the Tagus, all flow east to west; the Guadiana is the only large river of Portugal which deviates from the general west direction, and flows mainly south. In addition to these rivers, for which Portugal is indebted to Spain, she claims as peculiarly her own the Vouga, Mondego, and Sado. Numerous small lakes are scattered over the surface and embosomed in the mountains.

Climate.—The climate is greatly modified by the proximity of the sea and the height of the mountains, the former tempering the excessive heat of summer by refreshing breezes, and the latter making the winter more rigorous than usual in countries under the same latitude. In general, however, winter is both short and mild, and in some places never completely interrupts the course of vegetation. In consequence of this many parts of Portugal enjoy the

benefit of a double spring. Early in February vegetation is in full vigour; the plants shoot forth rapidly, attain maturity, and either wither away, or if of economical value are gathered and harvested. During the month of July the heat is often extreme, and, rain seldom falling, the whole country, particularly at its lower levels and along the coast, assumes a very parched appearance. The drought generally continues throughout August and far into September; but at last the sky, which had previously been serene, becomes overcast, and copious showers descend. The second spring now begins, and the fields again become covered with flowers and verdure. Winter begins at the end of November. In the mountainous districts the loftier summits obtain a covering of snow, and retain it for a greater or less period according to their altitude; but in all the country south of the Douro, and at a moderate elevation, snow generally soon melts away. Deluges of rain, however, continue to fall, and violent hurricanes and thunder-storms are not unfrequent. Shocks of earthquake are sometimes felt, particularly in the vicinity of the metropolis, where the disasters produced in 1755 were fearful almost beyond description.

Vegetation.—There are few countries with a more varied flora than Portugal. The number of species has been estimated to exceed 4000, and of these more than 3000 are phanerogamous. Many of the mountains are clothed with fine forests, chiefly of hardwood, among which the oak, both the ordinary species, or *Quercus robur*, and the cork-tree, or *Quercus suber*, are conspicuous. In the central provinces, at a moderate elevation, magnificent chestnuts are very prevalent. In the south, in the province of Algarve, both the date and the American aloe are not uncommon. Fruits of excellent quality are common in every quarter, though it is only in the warmer and better-sheltered districts that the orange, lemon, and olive are cultivated with success on an extensive scale. The mulberry is admirably adapted to the climate, and by means of it a good deal of excellent silk is obtained; and a large extent of country is devoted to vine culture, caused partly by the demand for Portuguese wines in Britain. Agriculture, properly so called, is at a very low ebb, and Portugal fails in ordinary years to raise cereals in sufficient quantity to meet its own consumption. Barley and rye are important crops in the north, elsewhere wheat and maize are of more importance. In swampy localities some rice is grown. Among domestic animals the first place is due to the mule, of which very superior breeds have long been possessed and are carefully preserved. Sheep, goats, and hogs are very numerous, but little attention is paid to their improvement. Cattle are of comparatively less importance. The fisheries, especially those of sardines and tunny, are of considerable importance.

Manufactures, Trade, Money, &c.—Manufactures are still of very limited amount, although they have been rapidly increasing of late years, and cotton goods are now exported. Among the articles made to some extent on a wholesale or commercial footing may be mentioned: textiles at Lisbon; woollen cloth and other woollen stuffs at Portalegre, Covilhão, &c.; porcelain at Vista Alegre; delft and ordinary earthenware at Lisbon, Oporto, Coimbra, Beja, Estremoz, &c.; cottons at Oporto; prints and lace at Lisbon and Oporto; cotton-twist at Thomar; silks at Braganza, Chacim, Oporto, &c.; copper and tin ware at Lisbon and other places; corks, ribbons, embroidery, hats, confectionery, fine soap, jewelry and cut gems, glass, paper, wicker-work, and tobacco. Ship-building is carried on to some extent, vessels being constructed at Lisbon, Figueira, Oporto, and elsewhere. Trade has received considerable stimulus

from the formation of railways, of which about 1500 miles have been finished. The principal exports besides wine are cork, cattle, cottons, olive-oil, sardines and tunny fish, fruits, iron and copper pyrites, and horses; the principal imports are cereals, colonial produce, woollen, cotton, linen, and silk tissues, iron, steel, and various other metals, machinery, cured fish, coal, petroleum, timber, dyes, and drugs, &c. In 1900 the value of the exports was £7,240,000 (wine £2,362,000), imports £13,383,000. The bulk of the trade is with Great Britain and France, and the chief export to the former is wine. The value of the exports to Great Britain in 1900 was £3,241,367; imports of British home produce, £2,065,570. The value of the wine sent to Great Britain annually is over £1,000,000. Coal and cotton goods have the highest value among the exports from Great Britain to Portugal, with a considerable amount in iron (wrought and unwrought) and machinery. The length of sea-coast, with the harbours found upon it, and the number of rivers, furnish great facilities for trade, but all the other means of internal communication are very defective. Accounts are kept in reis, milreis or 1000 reis, and contos de reis or 1,000,000 reis. The value of the rea is so minute that the milreis is worth only about 4s. 4½d. The French metric system of weights and measures was introduced into Portugal between 1860 and 1863. The Portuguese *libra* was 1·012 lb. avoirdupois, the *arroba* was 32 libras, the *quintal* 4 arrobas. The chief linear measures were the *legoa*, or league of 18 to the degree; the *milha*, or common geographical mile; the *braça*, or fathom=7·4 feet; the *vara*, or yard, one-half of the former; and *pe*, or foot=about 13 inches. For dry measure the *mojo*=22 bushels; and for liquids the *almudo*=from 3·7 to 5·6 gallons, were used.

Government, Army, &c.—The Carta Constitucional of King Pedro IV., granted 25th April, 1826, and amended at various times, is the fundamental law of the kingdom. The crown is hereditary both in the male and female line, but with preference of the male. The constitution recognizes four powers in the state—the legislative, executive, judicial, and moderating. The last, which is equivalent to the royal prerogative, is vested in the sovereign. There are two chambers, the *Camara dos Pares* and the *Camara dos Deputados*. The two are called the *Cortes Geraes*. The peers are nominated by the sovereign, who also nominates the president and vice-president of the chamber. The peerage is hereditary in the direct line, but the law of 1885 provided for the gradual abolition of hereditary peerages. To get a vote for the chamber of deputies one must be at least 21 years old, and pay a tax of at least 500 reis, or be able to read and write. A deputy must have 400 milreis per annum. A new parliament is convened without interval on the dissolution of the old. All laws relating to the army and taxation must originate in the chamber of deputies. For judicial purposes Portugal is divided into comarcas, each having a court of first instance. There are appeal courts at Lisbon, Oporto, and Ponta Delgada (in the Azores); and a supreme court at Lisbon. The established religion is the Roman Catholic; all other faiths are tolerated. The church is governed by a patriarch at Lisbon, two archbishops at Braga and Evora, and fourteen bishops. Conventual establishments were suppressed by decree of 28th May, 1834, and their revenues applied to the redemption of the national debt. Their books were collected, and form a library of 30,000 volumes at Lisbon. There are only about 500 Protestants, mostly foreigners. Primary education is compulsory by law; but the law is not enforced, and the bulk of the children of the lower and middle

classes do not attend school. The University of Coimbra, the only one in the kingdom, has over 1000 students; the secondary schools have about 96,000, and the primary about 240,000 scholars. Comparatively few females attend school. The revenue now amounts to about £11,000,000, but it is somewhat exceeded by the expenditure. The debt amounts to nearly £120,000,000. The army consists of about 33,000 men on the peace footing, and 175,000 on a war footing. Compulsory service was introduced in 1895, and all above 21, with certain exceptions, are liable to serve 3 years with the flag, 5 in the first reserve, and 7 in the second. The navy is manned by over 5000 men, and is being steadily increased.

History.—One of the smallest states of Europe, and almost fortuitously formed, Portugal has nevertheless a history of the most eventful kind, and one epoch alone with a glory rarely surpassed. The interest of the heroic age of Portuguese history does not turn upon destructive wars, but upon a long succession of brilliant geographical discoveries, planned with the best knowledge of the times, and pursued through a succession of generations with the tenacity and perseverance necessary to command success, while by means of these discoveries and others directly stimulated by them the whole world was opened up to European civilization, and a new epoch of history begun of which this small westernmost state of Europe was the pioneer. The Phœnicians, Carthaginians, and Greeks early traded to this part of the peninsula, which was afterwards conquered by the Romans. (See LUSITANIA and SPAIN.) The latter introduced among the inhabitants, who were a branch of the wide-spread Celts, their own civilization; the country was several centuries later inundated by the Germanic tribes (Goths, Suevi, Vandals—see these names) and in the eighth century (712) was conquered by the Saracens. (See MOORS.) When the gallant Spaniards of the Christian kingdoms of Castile and Leon (see SPAIN) finally wrested the country between the Minho and the Douro from Moorish hands, they placed counts or governors over this region. Henry the Younger of Burgundy, whose grandfather Robert I., duke of Burgundy, was grandson of the French king Hugh Capet, came into Spain about 1090, to seek his fortune in the wars against the Moors. Alphonso VI., king of Castile and Leon, gave him the hand of his daughter, and appointed him (1095) count and governor of the conquered districts, which comprised the provinces Entre Minho e Douro, Trás os Montes, and a part of Beira, and the harbours of Oporto (Portus Calle), from which Portugal is said to have derived its name. The count resided at Guimaraens, owed feudal services to the Castilian kings, but was permitted to hold in his own right whatever conquests he should make from the Moors beyond the Tagus (1112). Henry, and still more his son Alphonso I., were successful in their wars. The latter defeated Alphonso, king of Castile, in 1137, and made himself independent. Threatened by the Moors in 1139, he gained the brilliant victory of Ourique, and was saluted on the field King of Portugal.

With these events begins the history of Portugal. The cortes convened by Alphonso in 1143 at Lamego, from which they afterwards took their name, confirmed him in the royal title, and in 1181 gave to the kingdom, which was acknowledged by the pope, Alexander III., a code of laws and a constitution. The crown was made hereditary in the royal family according to the rules of primogeniture, but could pass to the collateral lines only with the consent of the estates. In the failure of male heirs the daughters were to inherit the crown. The independence of the kingdom was solemnly declared. The form of gov-

ernment, however, prepared by the Cortes of Lamego, was by no means very definite, and the fundamental laws there promulgated were far from being kept inviolate. Alphonso himself made his kingdom tributary to the pope, but maintained his regal dignity against the Kings of Castile and Leon, with whom he was frequently at war. He extended his dominions to the borders of Algarve, and took Santarém in 1143. The capture of Lisbon (1147), which was effected by the aid of some English Crusaders and Hanseatics, who ascended the Tagus, was one of the most brilliant events of his warlike life. In 1162 he founded two military orders, the order of Avis (a village near Alemtejo) and the order of S. Miguel del Ala. Alphonso I. died 1185. He was succeeded by Sancho I., who began the conquest of Algarve; and he by Alphonso II. about 1212, who was excommunicated and had his kingdom put under interdict by Pope Honorius III. Sancho II., who succeeded him in 1223, was also excommunicated, and compelled to leave the kingdom in 1245. He died at Toledo in 1248, and was succeeded by his brother Alphonso III., who completed the conquest of Algarve (1251). He was excommunicated, and Portugal was again laid under interdict by Pope Innocent IV. in 1257. The immediate cause of his excommunication was the repudiation of his wife and his marriage to another. He died in 1279. Dionysius (1279–1325) opposed the encroachments of the clergy, who here as elsewhere accumulated the property of the country in their hands, and claimed exemption from taxation; yet he contrived to remain at peace with the pope. By turning to account the favourable position of the country for commerce he laid the foundation of the future greatness of Portugal. He equally encouraged agriculture, manufactures, navigation, and commerce. He admitted the representatives of towns to the Cortes. He liberally patronized learning, and founded a university at Lisbon, which in 1308 he transferred to Coimbra. By these and other acts of a wise and beneficent administration he earned the title of *father of his country*. Among his other epithets the most frequently applied is the *Farmer*. His reign was disturbed by war with Castile from 1295 to 1297, and at different periods by civil feuds in his own family. The order of Christ, which he instituted, obtained the estates of the Templars on the abolition of that order in 1319. He was succeeded by Alphonso IV. In conjunction with Alphonso II. of Castile he defeated the Moors at Salado in 1340. He murdered Inez de Castro, the wife of his son Pedro, in 1355. (See INEZ DE CASTRO.) He was succeeded by his son Pedro I., who exhumed the body of Inez, and caused her to be crowned along with him (1361). He died in 1367, and was succeeded by Ferdinand, on whose death in 1383 the male line of the Burgundian princes became extinct. His daughter Beatrice, wife of the King of Castile, should regularly have succeeded him; but the Portuguese were so averse to a connection with Castile that John I., natural son of Pedro, grand-master of the order of Avis, was saluted king by the estates. He maintained possession of the throne, having, with the assistance of his general, Alvaro Nunes Pereira, defeated the Castilians at Aljubarotta in 1385. With him begins the native line of Avis. After having concluded a peace with Castile in 1411 this excellent prince turned his attention to the improvement of the country. He ruled with a wise moderation a turbulent people and a haughty nobility, whose power had been increased by the concessions which he had been obliged to make to secure their concurrence in his accession to the throne. He transferred the royal residence from Coimbra to Lisbon. In 1415 he took Ceuta, the first of a series of enterprises which

beginning with attempts at conquest on the African coast, resulted in those great expeditions of discovery on which the renown of Portugal rests. It was here that Henry the Navigator, his third son, began to form the plans of maritime discovery which led to such great results. In this reign were founded the first Portuguese colonies, Porto Santo (1418), Madeira (1420), the Azores (1433), and those on the Gold Coast of Guinea. John died of the plague in 1433. The reigns of his son Edward (till 1438) and his grandson Alphonso V. were less brilliant than that of John I.; but the latter was surpassed by that of John II. (1481-95), perhaps the ablest king that has occupied the throne of Portugal. In his reign began a violent struggle with the nobility, whose power had gained great accessions under his indulgent predecessors. The grants of crown lands made by them were revoked, and the judicial privileges of the nobility were restricted by the appointment of professional judges. The king caused the powerful Duke of Braganza, the chief of the turbulent nobles, to be beheaded, and put to death with his own hand in 1483 their next leader the Duke of Viseo. The expeditions of discovery were continued with ardour and with scientific method. The rich profits of the trade with Guinea supplied resources for new enterprises. The active spirit which was now more and more evidently developed among the Portuguese was quickened by the Jews, 83,000 of whom, driven from Castile, were received into Portugal on the payment of a capitation tax, and the most learned of this nation were then to be found in Portugal. In 1481 John sent two experienced men to attempt to reach by land the East Indies, the commercial wealth of which was the great object of his enterprises. Bartolomeo Diaz doubled the Cape of Good Hope in 1487, and Vasco de Gama reached India in 1498. In 1500 Cabral took possession of Brazil. For further details of Portuguese maritime enterprise see COLONY and INDIA—Portuguese India. These discoveries of Portugal are justly regarded as forming an epoch in European history, and are commonly held to be the starting-point of modern as distinguished from mediæval history. (See HISTORY.) Occupied with these great enterprises Portugal had neglected Columbus, whose discovery of America was made on behalf of Castile. Hence arose disputes between the navigators and colonizers of the two nations, which Pope Alexander VI. vainly attempted to settle in 1494 by his preposterous decree assigning to Portugal all countries to the east of a line of demarkation drawn 100 leagues west of the Azores and Cape Verd Islands, and to Spain all to the west of that line. While these great events were still in progress John II. was succeeded by his cousin Emanuel, who reigned from 1495 to 1521. The conquests of Albuquerque and Almeida made him master of numerous possessions in the islands and mainland of India, and in 1518 Lope de Soares opened a commerce with China. Emanuel ruled from Babelmandeb to the Straits of Malacca, and the power of Portugal had now reached its height. On this distant stage were performed great deeds of heroism, and this is the most glorious period of Portuguese history. But as in the case of Spain there is a dark side to the picture. The intolerant bigotry of superstition, which was then commonly mistaken for religious zeal, while it prompted to efforts for the conversion of the natives of India and America, too often inspired not merely the vulgar throng of adventurers who rushed to participate in the advantages of the new conquests, but likewise their chiefs and leaders, with a contempt for the infidels which combined with an insatiable avarice to produce deeds of cruelty equally revolting in their

details and astounding in their magnitude. Lisbon became the most important commercial city of Europe; but the wealth which commerce accumulated was hardly sufficient to meet the expenses of the campaigns in Africa, where the arms of Emanuel were less successful. The King of Congo had indeed allowed himself to be baptized by the missionaries, without whom no discovery-ships then sailed; and sent his two sons to Portugal to be educated; and the colony on the Guinea coasts, from which all other nations were excluded by the Portuguese, was a source of great wealth, but the enterprises in Northern Africa were unsuccessful. The unfavourable character of the country prevented a rapid progress, and it is highly probable that Venice and Spain, jealous of the Portuguese prosperity, secretly afforded assistance to the Moorish princes. In the reign of John III., son of Emanuel (1521-57), the Indian discoveries and commerce were still further extended; but the rapid accumulation of wealth through the importation of the precious metals, and the monopoly of the commerce between Europe and India, proved disadvantageous to home industry. The Inquisition was introduced in 1536, to be employed against those Jews who had adopted the externals of Christianity. John II. had received into the kingdom a great number of those whom the intolerant rigour of Ferdinand and Isabella had driven from Spain, but they were still treated with so much severity that Emanuel had at first intended to extend to them greater indulgence. But in the first intoxication of his passion for his wife, the beautiful Eleonora, sister of Charles V., the old king was persuaded to proceed with such rigour against the Jews as to require them to embrace Christianity, under the penalty of being deprived of their children and made slaves. Whether they found means to prevent the execution of this cruel order, or whether Emanuel feared the effects of their despair, it is certain that he allowed them twenty years for their conversion. This measure led a great many of the Jews to conform publicly to the Christian usages, while they secretly adhered to their faith. The Inquisition practised the most revolting cruelties on their descendants. Still more injurious in its consequences than the Inquisition was the admission of the Jesuits into the kingdom by John III. (1540), who received them into his dominions earlier than any other European prince, as if he had been doomed to undermine the prosperity of his kingdom. The artful Jesuits gladly allowed themselves to be employed as preachers of the faith in India, where the Franciscans had hitherto been principally employed. The education of his grandson Sebastian, the heir-apparent to the throne, was likewise intrusted by John to the Jesuits, the worst tutors of princes. They inspired the young prince with that spirit of bigotry and that fanatical ambition which led to his death. He resolved to reduce the Moors in Africa (an attempt in which his powerful predecessors had always failed), and persevered in his projects with a wilful obstinacy in opposition to the remonstrances of his wiser counsellors. In 1578 he lost his life in the battle of Alcazarquivir, and left his throne to the disputes of rival candidates, of whom the most powerful, Philip II. of Spain, obtained possession of the kingdom by the victory of Alcantara, and Portugal had the misfortune to be annexed to a kingdom which from this time was hastening its own decline by a series of unsuccessful wars, and by its unwise administration. The Spanish yoke was grievous to the Portuguese, and a tradition rapidly spread among them that their king was not dead. As in the case of the Russian Dmitri (see DEMETRIUS), a succession of impostors (four in this case) appeared; but the power of Philip was too great to be shaken, and their

efforts proved abortive. Portugal continued under the dominion of Spain till 1640, and her vast colonial possessions were united to the already splendid acquisitions of her rival, which was now supreme both in India and America. The opportunity of founding an empire such as the world had never seen was lost through the infatuated bigotry of Philip II. The Dutch, whom in his miserable and short-sighted policy he shut out of Lisbon, had, owing to the indolence of the Portuguese, been hitherto the carriers between them and the rest of Europe, and they now determined to open up a direct trade for themselves, and attacked the Portuguese as well as the Spanish possessions both in India and America. After a fierce struggle they deprived the Portuguese of the Moluccas in 1607, of their settlements in Guinea in 1637, of Malacca in 1641, and of Ceylon in 1658. They also acquired about half of Brazil, which, after the re-establishment of Portuguese independence, they restored for a pecuniary compensation. To these losses was added the rapacity of the Spaniards, who alienated the finest domains of the Portuguese crown. The Portuguese nobility, exasperated by this oppression and the contemptuous conduct of Olivarez, minister of Philip IV., entered into a conspiracy which was planned and executed with great art, and, December 1, 1640, placed on the throne John IV., duke of Braganza, a descendant of the old royal family. All the remaining colonial possessions of Portugal returned to her allegiance with the exception of Ceuta, which Spain succeeded in retaining. John IV. was succeeded in 1656 by Alphonso VI., who ceded Tangier and Bombay to Charles II. of England as a dowry on his marriage with the Infanta. He was deposed by his brother Pedro II. in 1667, under whom (13th February, 1668) a treaty of peace was concluded with Spain, which acknowledged the independence of Portugal. A commercial treaty had been concluded with England under the first Braganza prince, and in 1703 a new treaty was concluded, called the Methven Treaty, from the name of the English ambassador by whom it was concluded, which secured to England the advantages of the newly-discovered gold-mines in Brazil. From this time the relations with England continued to become more intimate, as Portugal was no longer in a condition to maintain an independent attitude in European politics. Pedro ceased to summon the Cortes after 1697. During the long reign of John V. (1706-50) some vigour was exerted in regard to the foreign relations, and something was attempted for the promotion of the national welfare at home (the restrictions on the power of the Inquisition, and the foundation of an academy of Portuguese history, for example), but in the former case without decisive consequences, and in the latter without a completion of the plans proposed; while the sumptuous monastery at Mafra, and the dear-bought permission to institute a patriarch of Lisbon, exhausted the resources of the country. Under his son and successor Joseph I. (1750-77) the Marquis of Pombal (see POMBAL), a vigorous reformer such as Portugal required, administered the government. He attacked the Jesuits and the nobility, who during the preceding reigns had exercised a secret influence in the government. The exposure of the power of the Jesuits in Paraguay, their conduct at the time of the earthquake in Lisbon in 1755, and the conspiracy against the life of the king (1759), led to the suppression of the order. In 1757 they had been deprived of the post of confessors to the royal family, and forbidden the court. Two years after all the Jesuits were banished the kingdom, and their estates were confiscated. The Count of Schaumburg Lippe, to whose services against Spain (1760) Portugal was

so much indebted, likewise reformed the Portuguese army; but soon after his departure the effects of his improvements disappeared. On the accession of Maria Francisca Isabella, eldest daughter of Joseph, in 1777, Pombal lost the influence which he had possessed for twenty-five years. To him Portugal owed her revival from her previous lethargy; and although many of his useful regulations did not survive his fall, yet the enlightened views which he introduced, and the national feeling which he awakened, were not without permanent effects. During the reign of Maria the power was in the hands of an ignorant nobility and a not less ignorant clergy. In 1792, on account of the sickness of the queen, Juan (John) Maria José, prince of Brazil (the title of the prince-royal until 1816), was declared regent (see JOHN VI.), and in 1799, her malady having terminated in a confirmed mental alienation, the prince was declared regent with full regal powers, but made no change in the policy of the government. His connections with England involved him in the wars of that power against France, and the Portuguese troops distinguished themselves by their valour in the Peninsular campaigns. But commercial distress, the accumulating debt, and the threatening language which Spain was compelled by France to adopt, led to a peace with France in 1797. The disasters of the French arms in 1799 encouraged the regent to renew hostilities in alliance with England and Russia; but after General Bonaparte had established his authority Spain was obliged to declare war against Portugal (1801), which, however, was terminated the same year by the Treaty of Badajoz, by which Portugal was obliged to cede Olivenza, with the payment of a large sum of money to Spain. Portugal meanwhile preserved a mere shadow of independence by the greatest sacrifices, until at last Junot entered the country, and the house of Braganza was declared by Napoleon to have forfeited the throne (on account of the refusal of the prince to seize the English merchandise in his dominions). The regent now threw himself entirely into the arms of the English, and November 29, 1807, embarked for Brazil. Junot entered the capital the next day, and Portugal was treated as a conquered country. An English force was landed, and in the northern provinces numerous bodies of native troops determined to sustain the struggle for freedom; a junta was also established in Oporto to conduct the government. After some hard fighting the decisive battle of Vimeira took place (August 21, 1808), which was followed by the Convention of Cintra and the evacuation of the country by the French forces. The Portuguese now took an active part in the war for Spanish independence. (See SPAIN.) On the death of Maria John VI. ascended the throne of Portugal and Brazil. This transference of the court of Lisbon into an American colony was followed by important consequences firstly, that Brazil attempted to withdraw itself from dependence on England; and secondly, that the colony gradually became a separate state. In Portugal, on the contrary, the influence of England continued, and the condition of the kingdom was not essentially changed. The Peace of Paris (May 30, 1814) by no means, therefore, corresponded to the expectations of the nation, although it had exerted itself vigorously in the common cause, and Spain evaded the restitution of Olivenza, which had been provided for by the Congress of Vienna at the same time that Portugal was required to restore French Guiana to France. The court of Rio Janeiro therefore occupied the Banda Oriental, and Portugal was involved in new misunderstandings with Spain. In 1815 the Inquisition was abolished in the Portuguese dominions; the Jesuits were refused admission into

them; and the Jews, at the request of the pope (1817), were allowed the same privileges which they enjoyed in the Roman states. The absence of the court was viewed with dislike by the nation; the military were dissatisfied with the influence of Marshal Beresford, and the general feeling required some fundamental changes in the administration and constitution of government. A revolution in favour of constitutional government was effected without bloodshed (1820), and the king invited to return home. Before landing in Portugal he swore to observe the constitution which had been adopted. A counter-revolution of the nobles and clergy was vigorously repressed by the Cortes (February, 1823); but the queen, a Spanish infanta, who exercised great influence over her son Dom Miguel, gained the colonels of several regiments; a new reactionary movement was organized; and the Cortes, being overpowered, dissolved itself after a solemn protest on 2d June, 1823. In 1822 Brazil threw off the yoke of Portugal, and proclaimed Dom Pedro, son of John VI., emperor. Her independence was recognized in 1825. John VI. died 10th March, 1826, having named the Infanta Isabella Maria regent. She governed in the name of the Emperor of Brazil, Dom Pedro IV. of Portugal, who granted a constitution with two chambers, modelled on the French, 23d April, 1826. In May he abdicated in favour of his daughter Maria da Gloria. He imposed on her the condition of marrying her uncle Dom Miguel, who was intrusted with the government as regent; but the absolutist party in Portugal set up the claim of Dom Miguel to an unlimited sovereignty, and a revolution in his favour, notwithstanding the intervention of England, placed him on the throne in 1828. In 1831 Dom Pedro resigned the Brazilian crown, and returning to Europe, with the aid of English partisans, succeeded in overthrowing Dom Miguel, and restoring the crown to Maria in 1833. In 1836 a successful revolution took place in favour of the restoration of the constitution of 1820, and in 1842 another in favour of that of 1842. Maria died in 1853. Her husband Ferdinand of Saxe-Coburg, brother of Prince Albert of Britain, became regent for her son Pedro V. He placed the government on a purely constitutional basis, which was maintained by his son Pedro, who died in 1861, and by Louis I., who succeeded him, and who died in 1889. The abolition of monopolies, the improvement of finances, the formation of railways, and the cadastral survey of the country, are among the measures which distinguished his reign. Slavery was abolished in 1868 in the Portuguese dependencies. The present king, Carlos I., ascended the throne in 1889. His reign has witnessed serious colonial, financial, social, and political troubles, and at one period (1890) a rupture with Britain in regard to Portuguese East Africa seemed likely.

Portuguese Language and Literature.—The nature of the language of ancient Lusitania is not known. Words of Greek, Phœnician, Iberian, Celtic, and Carthaginian origin are found in Portuguese as in Spanish, indicating the relations into which commerce or conquest had brought the early inhabitants of the country. Apart from these local peculiarities the Portuguese is one of the Romance family of languages formed by the junction of the Latin-speaking Celts with the Teutonic races. The Moorish occupation has further infused into it a Semitic element. Under the early kings of Portugal all documents were written in Latin; judicial sentences were written in Latin till a comparatively recent time; it is still used in seals, coins, and monumental inscriptions. It was only under Alphonso III. and Dionysius (Diniz) that Portuguese began to be generally used in documents. The differences between Portuguese

and Spanish are comparatively of modern origin, the two languages being very nearly alike in the time of Alphonso I. These differences are due partly to the different spheres of activity of the two peoples. The relations of Spain were with France, Italy, Austria, and the Low Countries; those of the Portuguese were almost exclusively with the Spaniards themselves, or with peoples removed from European civilization. The dialect of Spanish spoken in Portugal at the beginning of the monarchy, moreover, was the Galician, which was also that of the court of Leon; but that court subsequently adopted the Castilian, which became the dominant language of Spain. The decline of the Galician dialect in Spain and the formation of the Portuguese language through the influences peculiar to the people finally determined the separation of Spanish and Portuguese, and from cognate dialects made them distinct languages. Early French introduced by Henry of Burgundy and his suite also constituted an element in the formation of the Portuguese language, and old French words which have fallen into desuetude are still to be found in Portuguese. The French terms of heraldry were introduced as by the Normans into England, and the devices of the oldest Portuguese families are in French. In modern times, since the period of the French revolution, the Portuguese, notwithstanding their resistance to the aggressive designs of Napoleon and their close relations with England, have shown a strong tendency to imitate the French in everything, and the language has been considerably modified by the introduction of French expressions and grammatical forms.

The sixteenth century is the classical age of Portuguese literature, and the Royal Academy of Sciences has begun a dictionary in which all doubtful points in regard to the language are referred to quotations from the writers of that age. There is no determined orthography except that which the rules of printers have made prevalent in printed books. Royal edicts and other public documents were formerly cited as models of language, but in later times they were far from being distinguished by accuracy.

The Portuguese language has by means of colonization and emigration been pretty widely spread. It is spoken in Portugal, the Azores, Brazil, the Portuguese colonies in Asia, Africa, and America, and among the Portuguese Jews scattered over Europe, particularly in Hamburg and Amsterdam. The Portuguese possesses the richness and conciseness of the dialects founded on the Latin tongue. It appears to have derived from French the *j* sound and the nasal syllables, and it wants the strong aspirations and guttural sounds of the Spanish. It has less dignity than the Spanish, but is superior to it in flexibility. In popular songs it displays a delicacy and variety of expression which have made the Spaniards call it the language of flowers. It makes free use of augmentatives and diminutives. It is soft and sonorous in sound, but the too frequent occurrence of the nasal *ão* somewhat mars its harmony. The words are systematically grouped, every substantive having in general an adjective, a verb, and an adverb corresponding to it. Latin terms are preserved in Portuguese which are found in no other language in Europe; but these, as well as its other Latin elements, are more radically changed than elsewhere, so that it is often extremely difficult to trace the derivation of Portuguese words. Medial consonants, such as *l* and *n*, are frequently suppressed, *doler* becomes *dor*; *populus*, *povo*; *ponere*, *por* (Italian *porre*). The dialects of Portuguese differ only slightly from each other. Those of Minho, Algarve, the Azores in Europe, and of Goa, Macao, Congo, Mozambique, and Brazil are furthest from the written. The *lingos*

geral spoken on the eastern and western coasts of Africa, as well as in some parts of India and Ceylon, and which bears an analogy to the *língua franca* of the Mediterranean, may be regarded as a dialect founded on Portuguese, and as containing reminiscences of the ancient maritime power of the people. Among works on the Portuguese language we may mention *Grammatica da Língua Portuguesa* por J. de Barros (4to, Lisbon, 1540), *Origem da Língua Portuguesa* por Dur. Nũez de Leão (4to, Lisbon, 1606), *Vestígios da Língua Arabica em Portugal* por Fr. João de Souza (small 4to, Lisbon, 1789), *Diccionario da Língua Portuguesa* por Moraes e Silva (two vols. small folio, Lisbon, 1831), *Diccionario da Língua Portuguesa*, by F. A. Coelho (1890); *Grammatica Portuguesa*, by João Ribeiro (1889); Reinhardt-stöttner's *Grammatik der Portugiesischen Sprache* (1897). Among English works are dictionaries by Vieyra (1873-75; also an abridged ed.), Lacerda (1866-71), and Michaelis (1893); and grammars by Vieyra, A. J. D. D'Orsey and A. Elwes.

Literature.—The oldest monuments of Portuguese literature do not go back further than 1125, from which date the poetical compositions of Egaz Moniz Coelho and of Gonzales Hermiguez. These are written in the Galician dialect. This dialect closely resembled the Provençal, and the Provençal bards who were received at the court of the kings of Portugal just missed assimilating the Portuguese as well as other languages of Southern Europe to their own. The Provençal literature in fact for some time absorbed all the efforts directed towards the cultivation of the higher arts of writing, and in Portugal, as elsewhere, it retarded the development of the native literature. During the twelfth and thirteenth centuries the Portuguese native literature could boast of nothing more than a collection of popular songs (*charras*), remarkable for freshness and vigour. The first Portuguese collection of poetry (*cancioneiro*) was made by King Dionysius. It consisted of a selection of the court lays composed about his time by the Portuguese, Provençal, and Galician bards. The manuscript of this collection, discovered in the Vatican by Ferd. Wolf, has been published in Paris and Lisbon (1847) under the title of *Cancioneiro del Rey Dom Diniz*. To Dom Pedro, count of Barcellos, son of Dionysius, is attributed a *Cancioneiro do Real Collegio dos Nobres*. His half-brothers, Alphonso IV. and Affonso Sanchez, were likewise poets. Some of the Portuguese poets of this time wrote in Castilian, and are reckoned among Spanish writers. Some poems on the death of his wife, one of which is in Castilian, are attributed to Pedro I., husband of Inez de Castro. There is also a prose chronicle of Pedro's reign by Fernão Lopez, from which are derived the chief particulars of his vengeance on the abettors of the murder. In the fifteenth century the court was still the centre and source of the national literature. The sons and grandsons of John I. were poets and patrons of the troubadours. Galician, Castilian, and Provençal were still cultivated as well as the native language. Garcia de Resende, a poet of some merit, who lived under Emanuel, has collected in a *Cancioneiro* (Lisbon, 1516) the principal poetical works of this age. Bernardim Ribeiro wrote pastoral poems and romances in imitation of the Italians and Spanish. Sã da Miranda, who succeeded him in the same line, marks the transition from the fifteenth to the sixteenth century and the separation of the Portuguese from the other Spanish dialects and from the language of the troubadours. This progress is also observable in the prose chronicles which record the current history of the day. The reign of King John, the discovery and conquest of Guinea, the career of Prince Henry, and the first voyage of

Columbus are among the subjects dealt with by the chroniclers. Literature still continued to be patronized by the royal family. King Edward (Duarte) wrote a book of morals for the use of his sons, and two works, *The Art of the Cavalier* and *The Loyal Councillor*, which have been republished in France by J. J. Roquette. There is also a treatise on military art by Alphonso V. The sixteenth century is the classic era of Portuguese literature. Pastoral poetry, the epic, and the chivalric romance flourished in an especial manner. The chief names are Sã da Miranda, Antonio Ferreira, Camoens, Diego Bernardes, Andrade, Caminha, and Alvares do Oriente. Their compositions are distinguished by elegance and variety, but, like other modern pastorals, exhibit rather a tedious affectation of rusticity than a life-like representation of rural life. Sã da Miranda has also written epistles, sonnets, hymns, and other compositions. In his hymns he has employed for the first time the hendecasyllabic verse, which has become the chief instrument of Portuguese poetry. The numerous hymns, odes, elegies, and sonnets of Camoens are equally distinguished for elegance, but are marred by numerous conceits according to the taste of the period. The principal epic and the greatest poem in the Portuguese literature, almost the only one which has acquired a European reputation, is *Os Lusíadas* (The Portuguese) of Camoens, which has placed its writer in the rank of the few great poets of the highest class whose genius is universally recognized by the whole world. (See CAMOENS.) After Camoens as an epic writer comes Cortereal, who has celebrated the siege of Diu and the shipwreck of Sepulveda. Like Camoens he shows himself a great painter of nature.

The Portuguese romance writers claim to be the originators of the character of Amadis, but the question remains undecided between them and the Spaniards. Vasco de Lobeiro, Francisco Moraes, and Bernardim Ribeiro are among the leading romance writers. Lopez de Castanheda has written a *Libro de Caballeria*. The drama also began to be cultivated in the sixteenth century. The first *autos* and rustic dialogues were probably composed for the festivities of Christmas; a few rude comedies also preceded the classic period. Sã da Miranda studied and imitated Plautus. Ferreira, who followed his example, composed the first regular tragedy, *Inez de Castro*, only a few years after *Sofonisba* was produced at Rome by Trissino. Camoens wrote several theatrical pieces, among which are *Amphitryon* and *Seleucus*. *Autos*, *farsas*, and *comedias magicas* were far more numerous than regular pieces.

The chronicles in the same age expanded into history. The events of their own day in which their country played so large a part afforded ample matter of inspiration for historians as well as poets. Barros, also a romance writer, is esteemed the Livy of Portugal. He wrote the *History of the Conquest of India* in a style at once elegant, pure, and energetic. The *Commentaries of Alphonso d'Albuquerque*, by a nephew of the conqueror; the *Chronicle of King Manuel* and of Prince John, by Damian de Goes, a Portuguese ambassador; the *History of the Discovery and Conquest of the Indies*, by Lopes de Castanheda; the *Chronicle of King Sebastian*, by Diego Bernardo Cruz, are all works of great merit. Narrations of voyages are fewer than might have been expected, but there are a few of great interest—A Letter to the King of Portugal on the Discovery of Brazil, by Vas de Caminha, companion of Cabral; the *Voyages of Magellan*, narrated by some of his comrades; and the *Voyages of Pinto*, who visited China, Tartary, Arabia, and other countries. This work is one of the classics of the sixteenth century.

The opening of the seventeenth century is distinguished by the crowd of imitative epics which naturally followed the success of the *Lusiad*. Quevedo de Castro, Mascarenhas, and Brandam are among the principal authors of these works, the most noticeable feature of which is the national patriotism they continue to display after the loss of the political independence of Portugal. This century is also distinguished by great historical compilations. It was the period of repose after an epoch of great activity, and the absorption of the Portuguese nationality in the more powerful monarchy of Spain naturally turned all eyes to the recent period of its glory. The *Monarchia Lusitana* (1597-1690), Bernardo Brito's *Eulogy of the Kings of Portugal*, Faria de Souza's *Europa Portuguesa* (1667), *Asia Portuguesa* (1666-75), *Africa Portuguesa* (1680), *America Portuguesa* (left in manuscript), the historical works of Nunes de Laio, Manoel de Mello, and others belong to this epoch. Antonio Vieira, a Jesuit preacher, is one of the most vigorous prose writers of this century. The letters of Alcofarrada are also among its notable productions. But the most prolific writer of all was the padre Macedo, who composed a number of epic poems, besides 110 odes and numerous dissertations. He wrote chiefly in Latin, Spanish, and Italian.

The Portuguese drama was nearly extinguished during this century by the predominance of the Spanish, to which even Portuguese writers contributed. Cocho Rebello has collected a number of the minor indigenous productions of the art—*A Musa Entremetida de Varios Entremeses* (Coimbra, 1658).

In the eighteenth century the influence of the French writers of the age of Louis XIV. so completely dominated Portuguese literature that it became almost entirely imitative. Translations from and imitations of the French formed the staple of its products in every department, and the nation that gave birth to the *Lusiad* condescended to copy the *Henriade* and the *Lutrin*. Scholarship in this age made greater progress than literature. The academy called the *Academia* was founded in 1757 by Antonio Diniz da Cruze Silva, the Portuguese Boileau, and other promoters of the revival of learning. It became extinct in 1776, and was replaced in 1779 by the Royal Academy of Sciences of Lisbon. Towards the close of this century two writers appeared who have formed schools, Francisco Manoel do Nascimento (1734-1829), an elegant lyricist, and Barbosa du Bocage, who introduced an affected and hyperbolic style of writing, which has been called, from the signature *Elmano*, which he adopted, *Elmanism*.

In the nineteenth century the classic school has been represented by the followers of Manoel do Nascimento, Domingo Maximiano Torres, and Ribeiro de Santos. Agostinho de Macedo, a follower of Barbosa, has thought good to recast the *Lusiad* under the title of *O Oriente*. Among other modern poets possessing some claim to originality may be mentioned Roque, Carvalho Moreira, Mouzinho de Albuquerque, Feliciano de Castilho, Herculano de Corvalho, Almeida Garret, João de Lemos, Antonio de Serpa, and Palmeirim. Through the efforts of these and others Portuguese literature has again begun to assume an aspect of native vigour. The drama has also been revived by J. B. Gomez, Pimenta de Aguiar, Mendes Leal, and A. Herculano. Alexandre Herculano and Rebello da Silva are also writers of history and historic romance. Castello Branco is a novelist. To the Coimbra School, which found inspiration in the leading writers of modern France and Germany, belong the lyric poet João de Deus, the historian Theophilo Braga, the philologist Coelho, and other less-known writers. Science, law, and political economy are likewise well represented.

Art.—The principal architectural monuments which Portugal possesses are due to the Goths and Moors. There are also numerous architectural relics of the Roman dominion, such as the ruins of an amphitheatre at Lisbon, those of a Corinthian temple dedicated to Diana at Evora, and a round tower named after Sertorius. The cathedrals of Coimbra and Braga and the church of Cedofeita at Oporto are due to the Goths. The châteaux of Pombal, Feira, Alcobaca, &c., were palaces inhabited by the Saracen princes. There are no native works of any importance. Although the art has been well patronised Portuguese painters are few and have never formed a school. Native sculpture is represented by a statue of Joseph I., the only work worth mention in this department.

PORTUGUESE MAN-OF-WAR, the popular name of the *Physalia utriculus*, a Coelenterate organism, somewhat allied to the *Meduside* (which see) or Jelly-fishes, and included in the order *Physophoridae*, of the class *Hydrozoa*. The organism consists of a large spindle-shaped *pneumatophore* or 'float,' a bladder-like structure, containing within it a second sac, the *pneumatocyst*, and by means of which these forms float buoyantly on the surface of the sea. This float, which communicates by an aperture with the outer medium, may measure 8 or 9 inches in length, and consists essentially of a modification or dilatation of the attached extremity of the *cenosarc* or common medium by which the various parts of the organism are bound together. On the lower surface of this float the polypites, or separate zooids or individuals of which this compound form is composed, are situated; and long contractile tentacles and feelers or 'hydrocyts' are also found attached at this portion. The float possesses a wrinkled upper margin or crest. These organisms are abundantly supplied with thread-cells or *nide*, stinging or urticating organs with which the tissues of all Coelenterata are provided. See fig. at PROTOZOA.

The popular name of these organisms has been derived from the fancied resemblance of their form to sailing-ships. The entire structure is of glassy or fleshy consistency, and coloured white, with violet and purple hues. The *Physalie* mostly abound in warm and tropical seas, and vast fleets of these forms may be seen floating on the surface of the water. They are sometimes driven ashore on the British coasts, *P. pelagica* being the species most frequently found on our shores. The effects upon the human skin of the stinging powers of the thread-cells of *Physalia* have been described as being exceedingly severe and painful. The pain at first experienced is very severe, and its effects resemble those following smart blistering or even an acute inflammatory attack. Numbness of the affected part, an increased temperature, blistered surfaces, and other symptoms follow the stinging of a vigorous *Physalia*.

PORTULACÆÆ, or PURSLANES, a natural order of exogens, consisting of succulent shrubs or herbs, with alternate or opposite entire leaves, without stipules, axillary or terminal; unsymmetrical flowers, usually ephemeral and expanding only in bright sunshine; calyx of two coherent sepals; five petals, either distinct or cohering in a short tube; stamens hypogynous or irregularly inserted with the petals into the base of the calyx; several much-divided stigmas, and a dehiscent fruit with numerous seeds attached to a central placenta. The species are found in dry parched places, chiefly at the Cape of Good Hope and in South America. Only one species belongs to Europe. The distinguishing features of the plants are succulency, gay ephemeral flowers, insipidity, want of smell, and dull green foliage. *Portulaca oleracea*, or common purslane, has been known from

time immemorial, and used both as a pot-herb and in salad, on account of its cooling and antiscorbutic qualities. *Claytonia tuberosa*, a Siberian plant, has edible tubers.

PORTUMNUS, or **PORTUNUS**, among the Romans the god of harbours, the same as the *Melicerta* or *Palemon* of the Greeks. He had a small temple on the Tiber, and the *Portumnalia* were yearly celebrated in his honour. He bore a key in his hand as an emblem of his office.

POSEIDŌN, the Greek god of the sea, identified by the Romans with the Italian deity *Neptunus*. He was a son of *Kronos* and *Rhea*, and hence a brother of *Zeus*, *Hadēs*, *Hērā*, *Hestia*, and *Dēmētēr*. He was regarded as inferior in power to *Zeus*, although in Homer he is spoken of as equal in dignity. His usual residence was in the depths of the sea near *Ægæ*, in *Eubœa*, where he had a palace, and kept his horses with brazen hoofs and golden manes. The attributes ascribed and most of the myths regarding him have reference to marine phenomena. Thus he is called the earth-holder or earth-encompasser (*gaiōchus*), as the sea surrounds the earth, and the earth-shaker (*enochthōn*), as the earth is shaken by the waves of the sea beating on the shore. He is the ruler of all other marine deities and of all animals who live in the sea. He gathers clouds, and raises storms, and allays them. In several myths he is represented as contending with some land divinity for the possession of particular spots of land. Thus he contended with *Athēna* for *Attica* (see *MINERVA*), with *Hērā* for *Argos*, with *Hēlios* (the Sun) for *Corinth*, with *Zeus* for *Ægina*, with *Dionysos* for *Naxos*, &c. All these stories appear to have arisen from the observation of the tendency of the sea to encroach at various places on the land. The horse, and more particularly the war-horse, was sacred to *Poseidōn*, and one of the symbols of his power. The dedication of this animal to the sea god was probably due to the resemblance which the Greeks detected between the swift springing movement of the horse and the advance of a wave, or between the curve of a wave about to break and the arch of a spirited horse's neck. The horse is said to have been created by *Poseidōn* in the contest with *Athēna* above referred to. It was this god also who presented to *Peleus*, on the occasion of his marriage with *Thetis*, the immortal horses *Balius* and *Xanthus*, celebrated in the *Iliad* as the horses of *Achilles*. The other well-known symbol of his power is the trident, or three-pronged sceptre. During the Trojan war *Poseidōn* was the constant enemy of *Troy*. The cause of this enmity was the ingratitude shown him by *Laomedon*, the second king of *Troy*, and the builder of the walls of the city. It is said that having quarrelled with *Zeus*, he was compelled by the latter as a punishment to join with *Apollo* in helping *Laomedon* to build *Troy* walls, but that he first agreed with *Laomedon* that a certain reward should be given them when the work was done. As the stipulated reward was afterwards refused, *Poseidōn* sent a sea-monster to ravage the plains around *Troy*, and this monster was on the point of devouring *Laomedon's* daughter when it was slain by *Heracles*. But *Poseidōn's* anger was not satisfied with this punishment, and he ever after cherished a deep hatred against the *Trojans*. Hence in some of the engagements before the walls of *Troy* he is represented as appearing among the combatants on the side of the Greeks. In the *Odyssey* *Poseidōn* is described as thwarting the return of *Ulysses* to his home, for his having killed *Polyphēmus*, a son that had been born to the god by the nymph *Thoosa*. *Poseidōn* was married to *Amphitritē*, and by her was the father of *Triton*, *Rhodes*, and *Benthesicymē*; but he had nume-

rous other offspring by other mothers, divine and human. By *Dēmētēr*, or *Erinyes*, he was the father of the horse *Arion*, by *Medusa* of *Pegasus*, by *Theophane* of the ram with the golden fleece, and by other mothers of *Anteus*, *Polyphēmus*, *Pelias*, and *Neleus*. The worship of *Poseidōn* was common throughout Greece and the Greek colonies, but especially prevailed, as is natural, in the maritime towns. The animals sacrificed to him were horses and bulls, sometimes also wild boars and rams. The *Isthmian* games, and the *Panionia* or festival of all the *Ionians*, celebrated near *Mycalē*, were held in his honour. In works of art *Poseidōn* is represented with features resembling those of *Zeus*, but he has not the calm majesty of the supreme god, although he is more powerfully built. When represented standing he always bears the trident in his right hand and a dolphin in his left. A common representation of him is as drawn in his chariot over the surface of the sea by hippocamps (monsters like horses in front and fishes behind) or other fabulous animals; and not unfrequently he is accompanied by *Amphitritē*, *Triton*, *Nereids*, dolphins, &c.

POSEN (Polish, *Poznan*), GRAND DUCHY OF, a province of Prussia, bounded north by West Prussia, east by Poland, south by Silesia, and west by Brandenburg; area, 11,178 square miles. The surface is generally very flat, and extensively occupied by lakes and marshes. A small portion of it belongs to the basin of the *Vistula*, which merely touches it on the north-east; all the rest belongs to the basin of the *Oder*, which receives its drainage through the *Warta* in the south and centre, and the *Netze* in the north. The soil is for the most part light and sandy, and considerable tracts are covered with heath; but the far greater part of it either is, or is capable of being, brought under the plough, and many parts of it are covered with a rich alluvium or vegetable mould, yielding all the ordinary species of grain, millet, flax, hemp, tobacco, and hops. The pastures are extensive, and feed numerous herds of cattle, horses, and swine; considerable attention is paid to the rearing of poultry, particularly geese, and also to the rearing of bees. The minerals, not of much consequence, include bog iron-ore, saltpetre, limestone, and building-stone. The manufactures consist chiefly of woollen stuffs, linen, and leather. The trade in these articles, and in horses and swine is considerable; other exports are corn, cattle, tallow, leather, honey, wax, goose-feathers, and hogs'-lard. The inhabitants include a considerable mixture of Germans and Jews, but the great majority are Poles, Posen being one of the acquisitions which Prussia made by the dismemberment of Poland. It is divided into the two governments of Posen and Bromberg, Posen occupying the north half, and subdivided into sixteen circles (pop. 1,173,211; and Bromberg (pop. 655,447) occupying the south half, subdivided into nine circles. Total pop. (1900), 1,888,055. As part of Poland, Posen was divided into the palatinates of *Poznania*, *Gnesen*, and *Inowraclaw*. At the first partition of Poland in 1772 the district of the *Netze* fell to Prussia, and the remainder in the second partition of 1793. Between 1807 and 1815 Posen formed part of the Grand-duchy of Warsaw, but in the latter year reverted to Prussia.

POSEN, a fortified town in Prussia, capital of the province and government of the same name, on the river *Wartha*, 149 miles east by south of Berlin. It ranks as a fortress of the first class, and has been greatly strengthened since 1876 by a series of detached forts. Fort *Winiary*, adjoining the town, serves as the citadel. Posen is built with considerable regularity, but is more remarkable for the number than for the splendour of its public edifices. Of these the most deserving of notice are the cathedral and the

town parish church, both belonging to the Roman Catholics, and the former having the splendid 'golden chapel' attached; the archiepiscopal palace; the town-hall, a Renaissance building mostly of the 16th century; the Racynski library; the real-gymnasium, and two other gymnasia (one Protestant and one Roman Catholic), normal and other schools, hospital, a theatre, and some elegant private mansions. The manufactures consist chiefly of agricultural and other machines, carriages, artificial manures, &c. There are also several breweries and distilleries. Posen is the see of an archbishop, the residence of a provincial governor, and the seat of important courts and numerous public offices. It was one of the oldest and most important towns of Poland, and its inhabitants still largely consist of Poles. It was at one time a member of the Hanseatic League. Pop. (1880), 65,718; (1895), 73,235; (1900), 117,014.

POSES PLASTIQUES, or **TABLEAUX VIVANTS**, imitations of pictures in which living persons take the place of those depicted. A frame is made of sufficient width and height, and covered with gauze, behind which the persons stand in their proper attitudes, either invented by an artist for the occasion, or taken from celebrated historical pictures. Such exhibitions are sometimes produced on the stage.

POSITONIUS, a Stoic philosopher, born at Apamea, in Syria, probably about 135 B.C. He studied at Athens under Panætius of Rhodes, after whose death in 112 he visited most of the countries bordering on the Mediterranean, and finally settled as a teacher at Rhodes, whence he is called the Rhodian. He taught the Stoic philosophy with great applause, was at the same time a statesman and one of the Prytanes, and went when fifty years of age as an ambassador to Rome. The most distinguished Romans were his scholars, and Cicero himself was initiated by him into the Stoic philosophy. Posidonius removed to Rome in 51 B.C., and appears to have died not long after. He wrote many works which are now lost. In his physical investigations he was more a follower of Aristotle than of the Stoic school, the members of which he greatly excelled in this region of knowledge. The fragments of his writings were edited by Bake (1814), and by C. Müller (in *Fragmenta Historica Græcorum*, 1849).

POSITILIPPO. See **PAUSILIPPO**.

POSITIVE EYE-PIECE, the form of eye-piece generally used in microscopes and telescopes. It is well adapted for use with micrometers, its focus being outside the combination of lenses. It consists of two plano-convex lenses of equal focal length, the convex sides turned inwards, the distance asunder being two-thirds of the focal length of either. The focal length of the combination is three-fourths of the focal length of either.

POSITIVE PHILOSOPHY, or **POSITIVISM**, was the name made choice of by Auguste Comte to designate the system of philosophy which he began to publish in 1830, under the title of *Cours de Philosophie Positive*, in a series of volumes, which was completed in 1842. In 1846 it found its first English expounder and translator in Mr. G. H. Lewes, in the closing chapter of his *Biographical History of Philosophy*. Before that date it had been known in England only to a few men of science, and had rather been dipped into even by these few than thoroughly mastered. But in the case of Mr. Lewes himself it had gained a thorough convert. He had been an ardent student of metaphysics or ontology before he read Comte. 'Philosophy,' he tells us, in its old sense as distinguished from the sciences, 'had usurped too many of his nights and days, and had been the object and the solace of too great a portion of his bygone life to

meet with disrespect from him' in writing its history, or 'that he should ever think alightingly of it.' 'But we respect it,' he added, to mark the complete intellectual revolution which Comte had wrought upon him, 'as a great power that *has been*, and no longer *is*. It was the impulse to all early speculation; it was the parent of positive science. It nourished the infant mind of humanity; gave it aliment and directed its faculties; rescued the nobler part of man from the dominion of brutish ignorance; stirred him with insatiable thirst for knowledge, to a task which he was content to undergo amazing toil. But its office has been fulfilled; it is no longer necessary to humanity, and should be set aside. The only interest it can have is a historical interest. . . . Philosophy is an impossible attempt. It never has had any certitude; never can have any.' It was the *Philosophie Positive* which had chiefly helped to bring Mr. Lewes to these new and somewhat startling conclusions, and it was natural that he should end his work with some account of the new philosophy which had given him the advanced stand-point from which he had surveyed the whole course of philosophical and scientific thought, from its earliest rise in Greece down to the present day.

However much we may dissent from Mr. Lewes's repudiation of all metaphysical doctrines, we can have no difficulty in accepting him as a highly qualified expounder of the positive philosophy which he had so enthusiastically embraced, making, of course, all necessary allowance for the fervent zeal of a convert. 'Comte,' he thinks, 'is the Bacon of the nineteenth century.' Like Bacon he fully sees the causes of the intellectual anarchy which prevails in the world of mind, and also sees the cure. 'In the present state of things the speculative domain is composed of two very different portions, namely, general philosophical ideas and positive sciences. The general ideas are powerless because they are not positive, that is, not certainly known to be true; the positive sciences are powerless because they are not general. The new philosophy, which, under the title of positive, M. Comte proposes to create, and the basis of which he has himself laid, is destined to put an end to this anarchy, by presenting a doctrine *positive*, because elaborated from the sciences, and yet possessing all the desired *generality* of metaphysical doctrines, without possessing their vagueness, instability, and inapplicability. This is a gigantic attempt for one individual; but it has been undertaken by one possessing the thews and sinews of a giant, and the result is astounding. We have no hesitation in recording our conviction that the *Cours de Philosophie Positive* is the greatest work of our century, and will form one of the mighty landmarks in the history of opinion.'

The fundamental principle of Comte's whole system, and that which most broadly distinguishes it from all others, is 'that important law of mental evolution which he has not only discovered, but applied historically. It forms the keystone of the arch.' This law of knowledge or of mind-action for which nothing less than universality is claimed, and which is alleged to exemplify and verify itself in the whole intellectual history of our race, is now familiarly referred to as the law of The Three Stages. It may be thus stated in the words of Mr. Lewes:—'Every branch of knowledge passes successively through three stages. 1st, the *supernatural* or *fictitious*; 2d, the *metaphysical* or *abstract*; 3d, the *positive* or *scientific*. The first is the necessary point of departure taken by human intelligence; the second is merely a stage of transition from the supernatural to the positive; and the third is the fixed and definite condition in which knowledge is alone capable of progressive develop-

ment. In the *supernatural stage* the mind seeks after causes; aspires to know the *essences* of things and their modes of operation. It regards all effects as the productions of supernatural agents, whose intervention is the cause of all the apparent anomalies and irregularities. Nature is animated by superhuman beings. Every unusual phenomenon is a sign of the pleasure or displeasure of some being adored and propitiated as a God. The lowest condition of this stage is that of the savage, namely, fetishism. The highest condition is when one being is substituted for many as the cause of all phenomena.

'In the metaphysical stage, which is only a modification of the former, but which is important as a transitional stage, the supernatural agents give place to abstract forces (personified abstractions) supposed to inhere in the various substances, and capable themselves of engendering phenomena. The highest condition of this stage is when all these forces are brought under one general force named nature.

'In the positive stage the mind, convinced of the futility of all inquiry into causes and essences, applies itself to the observation and classification of laws which regulate effects; that is to say, the invariable relations of succession and similitude which all things bear to each other. The highest condition of this stage would be to be able to represent all phenomena as the various particulars of one general view.'

It is not to be understood, however, that because every branch of knowledge must pass through these three stages in obedience to the law of evolution, this progress is one strictly chronological. 'Some sciences are more rapid in their evolution than others; some individuals pass through these evolutions more quickly than others; so also nations. The present intellectual anarchy results from that difference, some sciences being in the positive, some in the supernatural, and some in the metaphysical stage; and this is further to be subdivided into individual differences, for in a science which on the whole may fairly be admitted as being positive there will be found some cultivators still in the metaphysical stage. The present condition of science exhibits three methods instead of one; hence the anarchy. To remedy the evil all differences must cease; one method must prevail. Auguste Comte was the first to point out the fact, and to suggest the cure, and it will render his name immortal.'

Another feature of Comte's philosophy which Mr. Lewes brings into prominence is his classification of the positive sciences, which Mr. Lewes eulogizes as both profound and luminous, and at the same time so simple and striking, that when once it has been stated the mind feels some difficulty in conceiving any other possible. The problem to be solved is the dependence of the sciences upon each other. This dependence can only result from that of the corresponding phenomena. The order of their dependence is determined by the degree of *simpleness* or *generality* of the phenomena. The principle, therefore, to be adopted is this, we must commence with the study of the most simple or general phenomena, and proceed successively to the most complex and particular. First of all, 'a distinction is to be made between the two classes of phenomena which are manifested by *inorganized bodies* and by *organized bodies*. The phenomena of the latter are obviously more complex than those of the former; they greatly depend upon inorganized bodies, while these in no way depend upon organized bodies. Organized bodies manifest all the phenomena of the inorganized, whether chemical or mechanical; but they also manifest the phenomena named *vital*, which are never manifested by inorganized bodies.' Carrying through this principle of division and distribution there emerges first the division of all physics into

two grand departments of inorganic physics and organic. Then follows the division of inorganic physics into celestial and terrestrial physics; of terrestrial physics into mechanics and chemistry; and next the division of organic physics into physiology and sociology. 'The positive philosophy therefore resolves itself into five fundamental sciences, of which the succession is determined by a necessary and invariable subordination founded on a comparison of corresponding phenomena. The first (astronomy) considers the most general, simple, and abstract phenomena—those farthest removed from humanity; they influence all others, but are not influenced by them. The last (sociology) considers the most particular—complex, and concrete phenomena—those most directly interesting to man; they depend more or less upon all the preceding classes, without exercising on the latter the slightest influence. Between these two extremes the degrees of speciality and of complication of phenomena gradually increase, according to their successive dependence. Such,' adds Mr. Lewes, 'is Comte's classification reduced to its simplest terms, a remarkable evidence of the profound and luminous intellect which originated it. A striking proof both of the correctness of this classification and of the truth of his great law of mental evolution is seen in the fact, that the history of the sciences teaches us how they all developed themselves into the positive stage, precisely in their successive order of dependence. Astronomy was the *first* to become positive, sociology is the *last*; between these extremes have come terrestrial physics, chemistry, and biology in successive development.'

These grand generalizations of Comte have a strong fascination for the scientific mind by their immense sweep, and by reason of the vast mass of facts belonging to science itself or to its history, which they include within their scope and reduce into luminous order or classification. But this vastness of sweep and apparent all-dominancy of standpoint is the weakness as well as the strength of this new philosophy. When a strict criticism is applied to the system it discovers in it many weak and unsound parts, many statements of fact in the history of human knowledge which are only partially true, many omissions of facts, which, when brought into view, impose serious limitations and corrections upon assertions which are made in too absolute a form; and not only so, but many perversions of facts, both past and present, which, if considered and applied in their true meaning, would be found quite irreconcilable with the lines of demarcation which Comte lays down in his Three Stages of Human Knowledge and Thought. Is it not a fact, for example, that Newton continued to take a theological or supernatural view of the origin and the conservation of the physical universe after his discovery of the law of universal gravitation, just as much as he had done before his discovery? Is it not another fact of the same kind that Pascal's theological thought and convictions touching the system of the universe came after his mathematical and scientific activity and triumphs—not before them? And in our own time, long after astronomy and all the other branches of inorganic physics have confessedly arrived at the positive stage, is it not a significant fact that so many of our leading physicists are so careful to rebut the charge of dogmatic atheism, and that even the 'cosmic philosophy' itself, based though it is on the doctrine of evolution, has still a theism of its own to show, however much this may differ from what it calls 'anthropomorphic theism'? Or to use its own words, 'With respect to the affirmation of a supreme power upon which man is dependent, our cosmic philosophy is as much at one with Christianity as

Christianity is at one with older religious philosophies.¹ What an emphatic rebuke is this last great fact to the overweening confidence and dogmatic arrogance of Comte's famous generalization of the Three Stages!—the supreme power recognized as distinctly by human science in its very last and ripest stage as in its very first and crudest! The philosophy of Herbert Spencer and John Fiske, both in the Old World and the New, still holding on to the theology of the first stage of science, although boasting of holding its place in the front line of progress among the foremost pioneers of inductive positive science!

But waiving farther strictures of our own, our remaining space will only allow us to trace a rapid outline of the criticism which the system has called forth from a number of eminent writers in this country and in America since the date of Mr. Lewes's first introduction of Comte's name to the English-speaking world. In 1858 Harriet Martineau published in two volumes a free and condensed translation of the *Cours de Philosophie Positive*, and in the same year Mr. Lewes gave to the world a much fuller and more precise Exposition of the Principles of Comte than he had had space to include in his *Biographical History of Philosophy*. In 1858 appeared the *Catechism of Positive Religion*, or a Summary Exposition of the Universal Religion, in Thirteen Systematic Conversations between a Woman and a Priest of Humanity; translated from Comte by Richard Congreve. These three publications greatly facilitated the study and understanding of the new philosophy and the new religion grafted upon it, and diffused a knowledge of their principles much more widely than before; and ere long the combined system called forth an ample reaction of theological, metaphysical, and scientific criticism.

Mr. Herbert Spencer led the way in 1864 in his pamphlet, *The Classification of the Sciences*, to which are added Reasons for Dissenting from the Philosophy of M. Comte. In 1865 Mr. John Stuart Mill followed with an elaborate and able critique of Auguste Comte and Positivism in the *Westminster Review*, which was afterwards published in a separate form, and which was of so much weight as coming from one of the chief thinkers of the age, that M. Littré, the foremost French disciple of Comte, found it necessary to publish a reply to it in the *Revue des Deux Mondes* of 1867, which also appeared in a separate pamphlet. These critiques of Spencer and Mill are all the more worthy of notice and study, that both these thinkers had come to be currently regarded as positivists of substantially the same school as Comte himself. But they had no wish, it now appeared, to be regarded in that light. With much in Comte's writings to admire and approve of, they also saw much to dislike and condemn. Much of what was true in them was not new, and a great deal of what was new in them was not true. 'Considered apart from the question of its truth,' Mr. Spencer observed, 'his system of positive philosophy is a vast achievement. But . . . there remains the inquiry, Has he succeeded? A thinker who reorganizes the scientific method and knowledge of his age, and whose reorganization is accepted by his successors, may rightly be said to have such successors for his disciples. But successors who accept the method and knowledge of his age *minus* his reorganization are certainly not his disciples. How then stands the case with M. Comte? There are some few who receive his doctrines with but little reservation; there are others who regard with approval certain of his leading doctrines, but not the rest: these we may distinguish as partial adherents. There

are others who reject all his distinctive doctrines, and these must be classed as his antagonists. Declining his reorganization of scientific doctrine, they possess this scientific doctrine in its pre-existing state as the common heritage bequeathed by the past to the present, and their adhesion to this scientific doctrine in no sense implicates them with M. Comte. In this class stand the great body of men of science, and in this class I stand myself.' Mr. Mill's critique is equally discriminating. He draws a broad line of demarcation between Comte's earlier and later works, in the former of which he finds much to approve, in the latter very little—so little that he regards many of the speculations which they contain as quite unworthy of the genius displayed in the earlier writings. He would fain cover them with a veil, they are so absurd and ridiculous. Singularly enough, however, Mr. Mill has a good deal to say in favour or at least in apology of what must seem to most men the most absurd and ridiculous of all Comte's creations, his new religion—what he calls the religion of humanity, the *cultus* of collective humanity spoken of as the *Grand Être*. And these passages of the critique have a double significance now, when laid side by side with some other passages contained in his three posthumous *Essays on Religion*, from which it would almost appear as if Mill had become a disciple of this new religion himself, or at least had become inclined to prognosticate that the worship of humanity might one day supersede in the world the worship of Christ and of God.

Other criticisms have followed on both sides of the Atlantic down to the present date. In his *Lay Sermons* (p. 164) Professor Huxley expresses himself very disparagingly of that portion of the *Cours*, &c., of which he is best able to judge. 'I found the veins of ore few and far between, and the rock so apt to run to mud, that one incurred the risk of being intellectually smothered in the working. . . . That part of Comte's writings which deals with the philosophy of physical science appeared to me to possess singularly little value, and to show that he had but the most superficial and merely second-hand knowledge of most branches of what is usually understood by science. I do not mean by this merely that Comte was behind our present knowledge, or that he was unacquainted with the details of the science of his own day. No one could justly make such defects cause of complaint in a philosophical writer of the past generation. What struck me was his want of apprehension of the great features of science, his strange mistakes as to the merits of his scientific contemporaries, and his ludicrously erroneous notions about the part which some of the scientific doctrines current in his time were destined to play in the future.'

In his *Lectures on Christianity and Positivism* (1871), Dr. McCosh of Princeton College had before him all these strictures of Spencer, Mill, and Huxley when he remarked that 'the world will soon be in a position fairly to estimate M. Comte, who has often been underestimated and as often overestimated. At first little appreciated by the mass even of thinkers, he secured at an early stage the admiration of a select few, who discerned the vigour of his intellect, and saw the partial truth which his system contained, or who were subdued by his dogmatic spirit and power of assertion. These men spoke of him in exaggerated terms, and compared him to Bacon and to Leibnitz. His direct influence has all along been very small, being confined to those who had the courage to read through his ponderous volumes. But his indirect influence, through eminent men who followed his method and caught his spirit, has been very great. However, the time of reaction against

¹ *Outlines of Cosmic Philosophy*, by John Fiske, formerly lecturer on philosophy at Harvard University (1874).

him and his exclusive pretensions seems to have come. These criticisms of Mill, Spencer, and Huxley show that his day is fast declining.' An elaborate and exhaustive critique of Comte's system is that supplied in Mr. Fiske's *Outlines of Cosmic Philosophy*, based on the doctrine of Evolution, with Criticisms on the Positive Philosophy. The criticism of positivism contained in this work is subordinate to the exposition and systematic presentation of cosmism—which is a new name for Mr. Herbert Spencer's philosophy, 'based on the doctrine of evolution'; and one of the objects of the work never lost sight of is to discriminate, carefully and exhaustively, between *cosmism* and *positivism*—which the popular mind is apt to confound with each other, as substantially if not formally identical. 'Accordingly, on every proper occasion the opinions characteristic of the positive philosophy are cited and criticised, and on every occasion they are proved to be utterly irreconcilable with the opinions characteristic of Mr. Spencer's philosophy, and adopted in this work. The extravagant claim of positivism to stand for the whole of attainable scientific philosophy is, I trust, finally disposed of, when it is shown that a system of philosophy has been constructed out of purely scientific materials, and by the employment of scientific methods, which opposes a direct negative to every one of the theorems of which positivism is made up.' Assuming the validity of the distinctions thus fully pointed out by Mr. Fiske, we must cease to confound the positivism of Comte with the phenomenalism of Spencer, Mill, Bain, and many other writers. In Dr. McCosh's work, quoted above, these three names, and those of Grote, Lewes, Buckle, and Huxley are all grouped with Comte's own as 'representatives of positivism'; and Mr. Fiske admits that there are really plausible reasons why the positive philosophy should currently be regarded as 'representative of that whole genus of contemporary thinking which repudiates the subjective method'. Dr. Edward Caird's work entitled *The Social Philosophy and Religion of Comte* (1885) is a critique from the metaphysical standpoint of a Hegelian, and Dr. Martineau's *Types of Ethical Theory* (two vols., 1885) also contains an examination of positivism.

One of the most striking features of Comte's system is the formal worship of Humanity (already referred to), as a collective representation of all men and women, past, present, and to come, whose lives have been, are, or will be, devoted to the uplifting of mankind and the progress of society. That the giving of due honour and reverence to the great and good has in itself an ennobling tendency there can be no question, but most, even of those who sympathize with this phase of positivism, cannot but feel that Comte invited ridicule by some of his proposed innovations, and especially by over-elaboration. Mr. Fiske has endeavoured to show that the main features of Comte's religious scheme are in curious accord with the ideal of mediæval Roman Catholicism. He attempted to settle almost every detail of ritual and observance, and by so doing was sure to alienate many who might be entirely at one with him in reverence for and devotion to his central idea. His reconstructed calendar (which was to begin with the great revolution year, 1789) forms perhaps the most notable and most characteristic instance of such over-elaboration, but it is by no means the least attractive. He redivides the year into thirteen months, and names these after some of the most celebrated men of all times and nations; and many other benefactors of mankind are also commemorated by having fixed days to which their names are attached like the saints' days of the ordinary calen-

dar. Comte was certainly sufficiently catholic in his views as to those who might be honoured in this way, since we find not only Alexander the Great, Cæsar, Charlemagne, and King Alfred; Abraham, Moses, St. Paul, and Mahomet; Homer, Shakspeare, and Milton; but also Prometheus, Hercules, Orpheus, and Ulysses all duly provided with places in his calendar. Professed adherents of the 'Religion of Humanity' were probably never very numerous, and it hardly seems likely that they have much increased. According to one of them 'where there are disciples or members, there, however limited their number, is a church', and there are a certain number of meeting-places in the cities of France and the continent of Europe, in England, and in America. The most prominent representatives of positivism in Britain to-day are Frederic Harrison and Edward Spencer Beesly, the latter of whom edits their excellent monthly organ, the *Positivist Review*, founded in 1893. M. Littré, the greatest of M. Comte's disciples in France, conducted for some years a review entitled *La Philosophie Positive*, but the movement is now represented in Comte's native country by the *Revue Occidentale*.

Bibliography.—Comte's own works include the following: *Cours de Philosophie Positive* (Paris, six vols., 1830-42; new ed. by Littré, 1864; abridged English translation by Harriet Martineau, two vols., 1853); *Discours sur l'Ensemble du Positivisme* (1848; afterwards incorporated in the *Politique Positive*); *Calendrier Positiviste* (1849); *Culte Systématique de l'Humanité* (1850); *Catéchisme Positiviste* (1852); *Système de Politique Positive* (four vols., 1852-54; Eng. trans., 1875-77, vol. i.—General View—by Dr. J. H. Bridges, vol. ii.—Social Statics—by F. Harrison, vol. iii.—Social Dynamics—by Prof. Beesly, vol. iv.—Future of Man—by Dr. Congreve); *Synthèse Subjektive* (vol. i., 1856—unfinished). See also Littré's works entitled, *Paroles de Philosophie Positive* (1863), *Auguste Comte et la Philosophie Positive* (1864), and *Auguste Comte et Stuart Mill* (1866); Pellarin's *Essai Critique sur la Philosophie Positive* (1864); Robinet's *Notice sur l'Œuvre et sur la Vie d'Auguste Comte* (1864); Mill's *Auguste Comte and Positivism* (1866); Bridges' *The Unity of Comte's Life and Doctrine* (1866, a reply to Mill); the works of G. H. Lewes above referred to; also those of Edward Caird, Fiske, Martineau, Huxley, Spencer, McCosh, &c. Mr. Harrison has edited a work on *The Positivist Calendar* (1891).

POSSE COMITATUS, in law, the power of the county, or the citizens who are summoned to assist an officer in suppressing a riot or executing any legal process: the word *comitatus* is often omitted, and *posse* alone used in the same sense.

POSSESSED, POSSESSION. See **DEMON.**

POST-CAPTAIN. See **CAPTAIN.**

POSTE RESTANTE. A letter so addressed is not intended to be delivered at the residence of the person to whom it is addressed; but to be left at the office till called for by the proper person, who is expected to give some proof of his identity, either in the form of a passport, or in some other way. At the poste restante in London, a person calling for a letter is not only required to give such proof, but also to state from what places he expects letters. This mode of addressing letters is frequently resorted to in the case of tourists and others having no fixed place of residence. Letters so addressed to one town on the Continent, if not called for there within a certain time, are sent in rotation to several of the other towns frequented by tourists, and if not called for at any of them are returned to the writer. In Great Britain letters addressed *poste restante* are kept one month, and then returned. In the provincial

towns of the United Kingdom no one having a fixed residence is allowed to have his letters addressed *post restante* to the post-town to which his residence belongs, and when such letters are received the officials are instructed to deliver them.

POSTERN, more frequently called a *sally port*, is a small gate generally made in the angle of the flank of a bastion, or in that of the curtain, or near the orillon, descending into the ditch, by which the garrison may march in and out unperceived by the enemy, to relieve the works, make sallies, &c.

POSTING, travelling by means of horses hired at different stations on the line of journey. Such a system appears to have been established by private enterprise on some of the main routes in England, at least as early as the reign of Edward II. It was afterwards made a government monopoly. As letters were originally forwarded in the same manner, the name of post-office has come to be applied to the institution charging itself with the conveyance and delivering of letters.

POST MORTEM ('after death'), a Latin term used as in the phrase *post mortem* examination, an inspection made of a dead body by medical men in order to ascertain the cause of death.

POST-NUPTIAL CONTRACTS, in Scotch law, are contracts entered into after marriage between the husband and wife, usually with the view of providing for the wife and children. The general rule by which such contracts must be construed, is that after marriage the wife and children can take nothing in competition with the creditors of the husband. Yet such a contract will be held to be valid even against them, provided that it was made while the husband was solvent, and the sum allotted to the wife or children by way of provision is not excessive in amount; and even when it was made after the contraction of debt by the husband, it will be considered valid to the extent of a moderate aliment for the wife, but not for the children. In English law, a contract of this nature is called a post-nuptial settlement, and is valid unless set aside by the statutes against fraudulent conveyances 13 Eliz. cap. v., made perpetual by 29 Eliz. cap. v., and 27 Eliz. cap. iv. s. 2, made perpetual by 39 Eliz. cap. xviii., which declare void any conveyance made with intent to defraud creditors or others of their actions, suits, debts, accounts, &c., or to defraud and deceive any person, bodies politic or corporate, who shall purchase the objects conveyed.

POST-OBIT BOND, a mode of contracting loans, often resorted to by heirs and others who expect a succession to open to them on the death of some third party. The condition in the bond is, that the sum borrowed shall not be exigible till that party's death; and hence, not only in consequence of the uncertainty of the event, but also sometimes in consequence of the uncertainty of the succession itself, which may be contingent, and perhaps never be realized, the creditor usually makes very exorbitant terms. Many cases have figured in the courts of law in which the sum advanced was not a tenth of that stipulated to be repaid.

POST-OFFICE, one of the most effective instruments of civilization, to be ranked with the art of printing and the mariner's compass. The name of *post* is derived from the Latin *positus* (placed), because horses were put or placed at certain distances to transport letters or travellers. We find the first recorded postal system in the Persian Empire. According to Xenophon Cyrus the Elder caused couriers, with saddled horses, to stand ready at different stations throughout the empire, situated one day's journey from each other, in order to receive reports from the provinces without delay. In the

time of Julius Cæsar the service of couriers in the parts of the Roman dominions under his government was so well organized that of two letters which he wrote from Britain to Cicero at Rome, the one reached its destination in twenty-six, and the other in twenty-eight days. Such services, however, were only established by governments or persons in authority for their own use. Private persons, in their intercourse with one another, had to employ slaves to convey their letters to their destination, or to trust to the chance of finding some person who was going to the place to which the letter was addressed, and was willing to undertake the delivery of it. Hence we meet with frequent complaints in the letters which have come down to us from ancient times, of the long delays in transmission. The emperor Diocletian, at the end of the third century, appears to have been the first to establish a postal system for the benefit of private persons, but we cannot tell how long this system remained in operation. At later dates Theodoric the Great, Charlemagne, and others who possessed for a shorter or longer time extensive dominions, had well-organized services for communication with all parts of their empire, but it is only at a comparatively late period that we find the beginning of the modern postal system intended for the use of the whole community.

The first traces of a postal system in England are observed in the statutes of Edward III.; yet the supposition is not well founded that from that time the post was established as a public institution. Edward IV. placed post-houses at intervals of 20 miles; and in the north a military post was established, to communicate as quickly as possible with the army during the Scottish war. This institution was, indeed, authorized by the reigning king; but it was probably owing to the king's brother Richard, who commanded the army. At what time and under what conditions the public were able to avail themselves of it we have no certain knowledge. That this post, nevertheless, was for a long time very limited, and but partially used, is obvious from the fact that, not long before the reign of Charles I., merchants, tradesmen, and professional men in the whole kingdom resorted to less secure means of conveyance, or employed express messengers, at great expense, to carry their correspondence. The universities and principal cities had their own *posts*—messengers who performed long journeys, riding or walking, and returned with the answers to the letters. In this manner the post was conducted in Scotland till a much later period. In 1543 a post existed by which letters were carried from London to Edinburgh within four days; but this rate of transportation, extraordinarily rapid for that period, lasted but a short time. After Camden, who was much employed by Elizabeth in her Scottish affairs, Thomas Randolph (in 1581) held the place of postmaster-general of England. James I. set on foot, under the superintendence of Matthew de Quester, a system for forwarding letters intended for foreign lands. Hitherto this had been done by private persons. The foreign merchants settled in London preserved long after the privileges belonging to the place of postmaster for foreign letters. In 1632 Charles I., by a proclamation, forbade letters to be sent out of the kingdom except through the post-office. In 1635 he established a system of posts for England and Scotland, which was conducted according to new and judicious regulations. All private and local posts were abolished, and the income of the post-offices was claimed by the king. This institution was under the direction of Thomas Witherings, who was removed in 1640, on account of notorious abuses. To him succeeded Philip Burlamachy, who

was under the immediate control of the secretary of state. These arrangements suffered during the civil wars many important interruptions, or were almost entirely annihilated. Yet no sooner was public tranquillity restored than a commission was appointed, and a postal system arranged, under the direction of the attorney-general, Edmund Prideaux, which became so profitable that the posts could now be leased for £10,000, while before the support of them had cost £7000. The lessee still made so large profits that the common council of London looked upon him with jealous eyes. In 1683 a penny post was set up in the metropolis. During the government of William III. acts of Parliament were passed which regulated the internal postal system of Scotland; and, by the ninth act of Queen Anne, the postal system of England was arranged on an improved footing, on which, with various modifications from time to time, indeed, it continued till the radical change of our own day, for which we are mainly indebted to the admirable sagacity and persevering labours of Mr. (afterwards Sir) Rowland Hill. That gentleman gave the first intimation of his plan in a pamphlet in the year 1837. The reasonings therein laid down, and the facts and figures adduced, were all convincing to the thinking portion of the British public. He plainly showed, on general principle, that the post-office system was at once costly and inefficient; that it had fallen, partly from the abuse of franking privileges (see FRANKING LETTERS) and partly from impolitic charges on payable letters, into a state of decrepitude; that the outlay, for the convenience it gave to the individual subject, was enormously great, while the returns to the state were disproportionately small. The average cost of each letter, for all distances in Britain, Mr. Hill showed, was then about 6½d. The post-office charges at that time were regulated by the following tariff:—For a single sheet letter sent 15 miles and under, 4d.; 15 to 20, 5d.; 20 to 30, 6d.; 30 to 50, 7d.; 50 to 80, 8d.; 80 to 120, 9d.; 120 to 170, 10d.; 170 to 230, 11d.; 230 to 300, 1s.; 300 to 400, 1s. 1d. For every 100 miles beyond, or portions thereof, 1d. more.¹ The results of these charges Mr. Hill thus summed up:—'From 1815 to 1820 the annual gross revenue of the post-office department was £2,190,597; from 1832 to 1837 it amounted to £2,251,424. The positive increase in seventeen years was £60,827, averaging only £3578 yearly, or little more than one and one-half per thousand; although in these seventeen years the increase of population had been 25 per cent, or 250 per thousand, and the advance in trade, industry, intelligence—in short, of every species of material and intellectual activity—was still greater.'

Mr. Hill soon had the happiness to get the legislature to adopt his magnificent plan, in its principal features at least—that of a uniform penny postage for all inland-borne letters and packets not exceeding a certain weight, commencing at ½ oz. By 2 and 3 Victoria, cap. lii., passed August 17, 1839, the great principle was adopted, and the Lords of the Treasury were empowered to take the necessary steps. Accordingly, on the 12th November following, their lordships issued a minute reducing the postage of all inland-borne letters, &c., to 4d. as a preliminary step. On the 10th January, 1840, the uniform rate of 1d. per ½ oz. for prepaid letters came into operation.

¹ The smallest sheet, if cut in two, was charged double postage. The inclosure of a note or a bill, or even one's address, if separate—in short, anything, however small—made the letter containing it double. Much keen investigation of suspected letters took place in a room set apart for that business. The searchers worked by gas-light, that of day being excluded.

While the cost of letter correspondence has been thus reduced, the rapidity of its transmission has been likewise much quickened. Palmer's mail-coach system, the great boast of the latter portion of the eighteenth century, still kept Edinburgh and Glasgow at three days' distance from London; they may now, thanks to the powers of steam, be reached in about one-ninth part of that time. Both these circumstances, together with the great development of commerce which has taken place in recent years, have had, as might have been expected, the effect of tremendously increasing the work done by the post-office department in Great Britain. In 1839 the total number of letters conveyed through the post-office was estimated at about 76,000,000; in 1842 the number had increased to 208,000,000. In 1901 it had reached 2,323,600,000. The revenue, of course, fell for a period; but in 1843 it had already reached £1,578,145, while the highest revenue that had previously been obtained from the department was only £2,400,000, which was the revenue for 1839. The net revenue in that year was £1,659,509. In 1852 the gross revenue on the new system overtook that which was yielded on the old, and it is still going on increasing. The net revenue exceeded the highest that had been obtained on the old system for the first time in 1856, when it was £1,660,229. In 1900–1901 the net receipts of the post-office amounted to £13,776,886, and the net expenditure upon it was £8,963,000, thus leaving a net revenue of £4,813,886. The telegraphs brought in £3,380,589, with an expenditure of £3,737,000. The net revenue from posts and telegraphs was thus £4,457,475.

Since the great postal reform of Sir Rowland Hill many important improvements have been made with regard to the management of the post-office business. The first of these improvements was the introduction of postage-stamps on the 6th of May, 1840. Before this prepaid letters were distinguished by a red mark, which continued to be used for some little time after the introduction of postage-stamps, until this mode of paying the carriage of letters in advance became universal. Another great improvement was the adoption of postal carriages on railways, by which the delivery of letters was greatly accelerated. These carriages are fitted up with a net-work on the outside, which may be let down on approaching stations in such a manner as to receive letter-bags which are dropped into it while the train is travelling at full speed. In the inside they are fitted up with pigeon-holes marked with the names of different towns, and the sorting of the letters may thus proceed during the transit. Sometimes bags are made up for stations on the line, and are thrown out as the train passes.

The rates of postage established in 1840 continued in operation till 1871, when a lower rate was introduced, namely, for every letter not exceeding 1 oz., 1d.; above 1 oz., but not above 2 oz., 1½d.; and ¾d. additional for every 2 oz. or fraction of 2 oz. up to 12 oz. From 1885 letters above 12 oz. are paid for at the same rate. Since 1897 a letter of 4 oz. is conveyed for a penny, ¾d. additional of postage being added for every 2 oz. or fraction of 2 oz. beyond the 4 oz. Letters not prepaid, or insufficiently prepaid, are charged double postage, or double the deficiency, on delivery. No letter can be conveyed by post if it is more than 2 feet in length, 12 inches in width, and 12 inches in depth, unless it proceeds from, or is sent to, one of the government offices. When special security is required for the delivery of a letter, the letter may be registered for a fee of 2d. in addition to the postage, which enables it to be traced, as each person into whose hands it passes must give a receipt for it, great security in trans-

mission being thus secured. The fee of 2d. serves to insure the letter and its contents up to £5 if lost or damaged, while a fee of 1s. 2d. insures it for £120, the highest amount that is insured. An unregistered letter found to contain coin or some article of jewelry may be charged fourpence on delivery. Any newspaper published at intervals not exceeding seven days, and registered at the General Post-office in London, may be sent by post to any part of the United Kingdom for one halfpenny. Strict regulations are laid down as to what will be regarded as a newspaper, and as to certain other points, and if the rules are infringed the packet may be charged as an insufficiently paid letter, or transferred to the parcel post (see below), whichever charge is the lower, and charged with a fine of 1d. in addition to deficient postage. The postage must be prepaid, and the paper must either be without any wrapper at all, or have one which is open at both ends, so that the paper may easily be removed for inspection. No newspaper, or newspaper cover, must bear anything except the names and addresses of the sender and addressee, a request for return in case of non-delivery, the title of the paper, and a reference to any place in it to which the attention of the person receiving it is called. Packets of newspapers may be made up and sent at the same rate as letters are sent at, up to the weight of 5 lbs., beyond which no newspaper packet can be conveyed. In size such packets must not exceed 2 feet in length, by 1 foot in width and depth. Of course newspapers may also be made up in parcels and sent by parcel post. Book-post packets used to be sent up to a weight of 5 lbs., but the weight of a book-packet is now confined to 2 oz., which costs ½d. The packets may contain books, and printed matter of various kinds, maps, plans, photographs, drawings, &c., provided there is nothing in the shape of a private letter; and if in a cover, the cover must be easily removed, leaving the packets and their contents open to inspection. Although book-packets must contain nothing of the nature of a private letter, circulars wholly or in great part printed or lithographed may be sent by book-post either singly or in packets, and a number of documents of the nature of personal communications may also be sent, as invoices, orders for goods, statements of account, receipts, certificates, licenses, notices or reports of courts, deeds, agreements, printed proofs with corrections and instructions, &c. But type-written circulars and letters are not admissible by book-post. Circulars, however, printed or lithographed in characters resembling those of the type-writer, or produced by some mechanical process from type-written originals, may be posted at the book-post rate if handed in over the counter, and if attention is called to their nature, and not less than twenty, exactly similar, are posted at once. If any letter or other private communication is found in the packet it will be charged as a letter. Since 1870 post-cards having a halfpenny stamp printed on them have been issued by the postal authorities, as a means of conveying any communication, whether written or printed, that the sender does not object to leave open to view. Reply post-cards may also be had. Private persons are also allowed to send their own post-cards with a halfpenny stamp attached to them. Such cards must resemble in size and in character the official cards. No communication of the nature of a letter can be sent through the post-office for a halfpenny except by a post-card. Since 1883 parcels may be sent by post between any places in the United Kingdom, the following being now the prepaid rate:—not exceeding 1 lb. in weight, 3d.; exceeding 1 lb. and not exceeding 2 lbs., 4d.; exceeding 2 lbs.

and not exceeding 3 lbs., 5d.; exceeding 3 lbs. and not exceeding 4 lbs., 6d.; and so on, up to 11 lbs., the charge for which is 1s., a parcel of this weight being the greatest that is allowed. No parcel may exceed 3 feet 6 inches in length, or, with length and girth combined, 6 feet. Many things may be sent by parcel post which are not allowed to be sent by letter post, such as liquids, glass, china, eggs, fruit, fish, meat, butter, &c., but of course the sender must be careful to see that they are properly packed, and the parcel should be labelled as 'eggs', 'fragile', 'perishable', &c. Anything indecent, or any explosive, or any live animal, is forbidden to be sent by post altogether. There is no prohibition against inclosing in a parcel a letter intended for the same address as that to which the parcel is sent. There used to be a special pattern and sample post, intended to be strictly limited to the transmission of bona-fide trade patterns and samples of merchandise; but the pattern post has been abolished, and pattern packets are now sent at the letter rate. Postage stamps for ½d., 1d., 1½d., 2d., 2½d., 3d., 4d., 4½d., 5d., 6d., 9d., 10d., 1s., 2s. 6d., 5s., 10s., 20s., and £5, may be used for receipts, telegrams, and certain other purposes. There is now an express delivery of letters, parcels, &c., the charge depending on the distance. A single letter may be sent by a railway train for 2d. additional. 'Letters, book-packets, post-cards, and newspapers are not liable to additional postage for re-direction, whether re-directed by an officer of the post-office or by an agent of the addressee after delivery, provided in the latter case that the letters, &c., are re-posted not later than the day (Sundays and public holidays not being counted) after delivery, and that they do not appear to have been opened or tampered with.' If re-posted later than the day after delivery they are liable to charge at the prepaid rate. Parcels when re-directed are liable to additional postage unless both addresses are in a delivery from the same office.

Other departments under the management of the post-office in Great Britain are the money-order department, the savings-bank department, annuities and life assurance department, and telegraph department. For the savings-bank department see BANKS, and for the annuities and life assurance department see POST-OFFICE INSURANCE. The money-order department was annexed to the post-office in 1838. The rates were then fixed at 6d. for all sums not exceeding £2, and 1s. 6d. for all sums exceeding £2 and not exceeding £5. In 1840 these rates were reduced to 3d. and 6d. respectively. The present rates are 2d. for sums not exceeding £1; 3d. for sums above £1 and not exceeding £3; 4d. for sums above £3 and not exceeding £10—which is the limit for one order. A new kind of money-orders came into use in 1881, in the shape of postal orders for fixed sums, forming a kind of small currency. The amounts of and charges on these notes are: 1s. and 1s. 6d., charge ½d.; 2s., 2s. 6d., 3s., 3s. 6d., 4s., 4s. 6d., 5s., 7s. 6d., 10s., and 10s. 6d., charge 1d.; 15s. and 20s., charge 1½d. There are now money-order conventions with most foreign countries and with all the colonies.

The telegraph lines of the United Kingdom have been worked by the post-office since February, 1870. An act passed in 1868 authorized the postmaster-general to buy up all the lines already in existence, to make extensions and improvements as occasion required, and to work them as part of the post-office business. A second, passed in 1869, gave the government a monopoly in telegraphing, with certain reservations in favour of railways, newspapers, and persons possessing or renting private telegraphs. The total number of telegraph offices at the time when the business was taken over by the state was 2982;

at the end of March, 1901, it was 11,512. The total length of postal telegraph lines at the end of March, 1901, was 46,295 miles, with 347,680 miles of wires (including lines rented by private persons). The rate (from Oct. 1, 1885) is 6d. for twelve words or less, and 3d. for every word afterwards, the addresses of sender and receiver being both charged for. Names of places, though of two words, are charged as one.

By act 7 and 8 William IV., and 1 Victoria, cap. xxxiii., the postmaster-general has the exclusive privilege of transmitting letters with the following exceptions: letters sent and delivered by a private friend; letters sent by special messengers on the private affairs of the sender or receiver; writs, &c., issuing from the courts of justice; letters sent out of the kingdom by private vessels; communications from owners of vessels or of their cargoes sent gratis; advices of goods sent by carriers to be delivered with the goods gratis. Some persons are altogether prohibited from carrying letters even for nothing, unless the letters are such as are allowed in the previous exceptions. Among those so prohibited are carriers, owners and masters of vessels passing from place to place in the British dominions, and passengers by such vessels.

Larceny in relation to the post-office is a serious offence, and punished with proportional severity. Every person employed under the post-office who, contrary to his duty, opens or detains a letter, or is accessory to its opening or detention, is guilty of a misdemeanour, and is liable to be punished by fine or imprisonment, or both. If he embezzle, secrete, or destroy a letter he is guilty of felony, and is liable to penal servitude for not more than seven, nor less than five years. If the letter contain any chattel or valuable article he may even be condemned to penal servitude for life. Equally severe punishments may be inflicted on those who commit thefts on the post-office, or knowingly receive articles stolen from the post-office, and who are not in its service. Any person who fraudulently retains or wilfully secretes, keeps, or detains a letter that ought to have been delivered to another person, or neglects or refuses to give up such a letter, is guilty of a misdemeanour punishable with fine and imprisonment. Telegraphic despatches are put nearly on the same footing as letters, but articles sent through the book-post are on a somewhat different footing. Any post-office employee embezzling, secreting, or destroying an article of the latter description is only guilty of a misdemeanour punishable by fine or imprisonment, or both. Any officer of the post-office who grants or issues a money-order with a fraudulent intent is guilty of felony, and is liable to penal servitude for not more than seven, nor less than five years, or imprisonment for any term not exceeding three years. The best source of information with regard to the British post-office is the Post-office Guide, published quarterly.

International postage was first provided for by the government of Great Britain in 1630, when Charles I. in connection with Louis XIII. of France established a post between London and Paris. Postal conventions were subsequently made between Great Britain and almost every other country in the world. In recent years an immense stride has been taken in the improvement of postal communication between different countries by the formation of the international postal union, the provisions adopted by which came into force on the 1st of July, 1875. The union has been greatly enlarged by numerous other countries joining it since that time, and only a few countries or regions now remain outside it, such as China, Abyssinia, Arabia, Morocco, &c. All the countries

in the union form a single postal territory, having a uniform charge for the letters, book-post packets, samples, &c., passing between them. Half-ounce letters may now be sent to any British possession, except the Australian colonies, the Bechuanaland Protectorate, and Rhodesia, for 1d. To these excepted countries and to all foreign countries the rate is 2½d. per ½ oz. Post-cards are carried for 1d. No letter for a colony or foreign country may exceed 2 feet in length by 1 foot in width or depth. To a few countries exceptional conditions apply, such as compulsory prepayment of postage, the collection of an additional charge on delivery, or the absence of arrangements for complete or even partial registration of letters. In general a letter, post-card, book-packet, &c., may be registered for a fee of 2d. Newspapers, book-packets, and other printed matter are transmitted at the rate of ¾d. per 2 oz. Packets for British possessions and non-union countries or colonies must not exceed 2 feet in length by 1 foot in width or depth; to foreign countries in the union the length is limited to 18 inches. A packet in the form of a roll must not be more than 30 inches long, by 4 in diameter. The limit of weight is 4 lbs. for countries in the union, and 5 lbs. for British colonies and possessions, or non-union territories. Packets must be made up similarly to inland packets. There is also an international parcel-post, but the rates and regulations vary so greatly that they cannot be given here. Each postal administration in the union retains the charges originally levied within its boundaries. A congress of representatives of the countries composing the union meets at least once in three years, to consider the working of the system, and introduce any improvements that may be thought necessary. In 1895 the number of letters that passed through the post in all the countries of the union exceeded 8780 millions, besides which there were about 2187 million post-cards, and 7925 million newspapers, &c., making a total of over 19,730 millions of articles; total in 1899, 21,454.

The earliest postal system in France that had any degree of permanence was established by the University of Paris. From the end of the thirteenth century this institution maintained couriers, who at certain times took charge of letters and money for the students collected in that city from almost all parts of Europe. Louis XI. established for his own use mounted messengers, and by an edict of June 19, 1464, instituted post stations at intervals of 4 leagues on the chief roads of France. This system was continued under the following reign, and ultimately private persons began to make use of the royal couriers for the transmission of their own correspondence. During the reign of Louis XIII., 1610–30, the French system of posts received a more regular form from the establishment of a controller-general of posts. They, as well as the postmasters named in 1630, received the revenue, till at length the minister Louvois, in the reign of Louis XIV., farmed out the posts to a certain Patin. In 1688, when the post was farmed out for the third time, the revenue amounted to 1,400,000 francs, and in 1695, when it was sold by auction unconditionally, to 2,000,000 francs. In 1733 this revenue amounted to 3,000,000, principally because the regency in 1719 had abolished the academical couriers (on which account the university at Paris had assigned to it, from the revenue of the post-office, 300,000 francs yearly, which was paid to it till the beginning of the revolution). In 1786, when it was leased for the twenty-third time, the sum paid amounted to 10,800,000 francs. At the expiration of the last lease in 1791, when the establishment reverted to the king, it produced a clear income of more than 11,000,000 francs.

The postal reform introduced into England by Sir Rowland Hill was to some extent adopted in France by the decrees of the 14th of August, 1848, which came into operation on the 1st of January, 1849. The charge for a single letter was then reduced to 20 centimes (2d.). In respect of cheapness of letter-carriage France is still behind some other countries, though latterly an advance on the side of cheapness has been made. In 1871 the postal rates were raised one-fourth, and for some time they stood at 25 centimes (2½d.) for prepaid letters not exceeding 10 grammes (a little above ½ oz.) in weight; 40 centimes (4d.) for letters above 10 grammes, but not above 20 grammes, and so forth. At present the rate for inland postage, including France, Corsica, Algeria, and Tunis, is 15 centimes (1½d.) for 15 grammes (fully ½ oz.), or any part thereof. Partly, perhaps, as a result of these high rates, while in Great Britain 45 letters are annually sent through the post-office for each of the inhabitants, only 20 are so sent in France. During the investment of Paris by the German troops in 1870-71 experiments were made with balloons as means of communicating with the provinces. In this way 2,500,000 letters are said to have been forwarded while the siege lasted.

In Germany the first post was established in Tyrol in the latter half of the fifteenth century, by Roger I., count of Thurn, Taxis, and Valsassina. His son established another from Brussels to Vienna in 1516, by the wish of the Emperor Maximilian I. In 1522 a post was established between Vienna and Nürnberg, where the diet sat, on account of the war with Solymán II.; but it ceased with the war. Charles V. was anxious to have news as quickly as possible, on account of the vastness of his states, and caused Leonard of Thurn and Taxis to establish a permanent riding-post from the Netherlands through Liège, Trèves, Spire, and Rheinhausen, through Würtemberg, Augsburg, and Tyrol to Italy. In 1543 Leonard was appointed postmaster-general of the empire. After the death of Charles V. the members of the empire were unwilling to allow a Spanish-Netherlandish post (such as that established by Charles V.) in their territories; yet Ferdinand I. confirmed Leonard in 1563. In 1595 he was appointed postmaster-general of the empire, in opposition to the wishes of the members; but several of them having already established posts in their dominions refused to acknowledge the exclusive privileges claimed by the imperial post. In 1615 Lamoral of Taxis was actually infeoffed with the imperial post as an imperial fief. Ferdinand II. extended this grant so as to make it descend to the nieces of Lamoral, and a regular post now went every week from the imperial court, and also from Rome, Venice, Milan, Mantua, &c., to Augsburg, and thence to Brussels and back. The post remained as long as the empire existed, one of its many ill-defined and unwieldy institutions, in which private or petty interest was allowed to stand in the way of the public welfare. The post was actually made a regular point in the *Wahlcapitulationen*, the stipulations between the electors and the candidate for the imperial dignity. The imperial posts were restricted, and the emperor himself excluded the Thurn and Taxis post from several of his dominions. In a country where so many small territories had their own posts it was natural that they should remain in a very bad condition, and it is only in recent times that they have been greatly improved, more especially in consequence of the general adoption of the Austro-German compact, by which the international posts were placed under one system of management. Impediments to the free development of the postal system still continued from the circumstance that in Heems, Nassau, in the states of the

Saxon-Ernestine line, Hohenzollern, Waldeck, &c., the post was left to the house of Thurn and Taxis as a fief. In some other states the Thurn and Taxis post was founded upon a regular compact. In 1867, however, the Thurn and Taxis system was abolished, and a uniform rate of 1 silbergroschen or 3 kreuzers (about 1d.) for a single letter was fixed for the whole of North Germany. Since the recent establishment of the German Empire a uniform postal and telegraphic system has been organized for the whole of Germany, and the passing of postal laws is now exclusively an imperial matter. The supreme administration resides in the emperor. Bavaria and Würtemberg still retain the management of their posts, however, and can make what arrangements they please with regard to their internal communications, or to their own immediate intercourse with neighbouring states not belonging to the empire. Postal treaties unite Germany to the Austro-Hungarian monarchy and Luxemburg. In some respects the German postal system affords greater facilities to the public than are granted by those of other countries. If any person wishes to communicate something to all the post-offices of a certain line (for example, an inquiry after an important parcel), an open paper may be sent by mail, which is read and forwarded by all the respective postmasters. A receipt for the delivery of any letter purporting to contain a particular sum may always be had, and this sum is paid if the letter is lost in the regular course of transportation. If the letter, however, should arrive in good order, and no money be found in it, the government would not be answerable in consequence of such a receipt. But if a man goes to the post-office with an open letter, and incloses a certain sum therein in the presence of the postmaster, the receipt of the government makes it liable, in any event, for the safe transportation of the money. To Germany is also due the introduction of post-cards, which were first proposed by Prussia at a postal conference held at Karlsruhe in 1865. A signal proof of the energy of the management of the post-office in Germany was given during the Franco-German war of 1870-71, in the establishment of the field-post, by which the troops in the field were enabled to communicate with their friends at home with as much regularity as if they had been stationed in towns of Germany. Large quantities of letters were despatched by this post at one time; on the 14th of January, 1871, for example, 267 letter-bags containing 160,000 letters.

The postal system of Italy arose in Piedmont. Until 1561 the transmission of letters was in the hands of the communes or private persons, who were authorized by the state to charge for the service a sum which varied according to circumstances. In the year mentioned the posts were farmed out by Emmanuel Philibert, duke of Savoy, to a postmaster-general. This arrangement continued till 1697, when Duke Victor Amadeus II. added the proceeds of the post-office to the revenue of the state, an indemnity being paid to the postmaster, who had the farming of them. From 1710 downwards the post-office was administered directly by the state. In 1818 the system of Piedmont was reorganized, and since the unification of Italy it has been extended to the whole kingdom.

The earliest mention of the establishment of a post-office in the British colonies of North America occurs in the General Court Records of Massachusetts of 1639, where we find the following entry:—"It is ordered that notice be given that Richard Fairbanks, his house in Boston, is the place appointed for all letters which are brought from beyond the sea, or are to be sent thither, which are to be left with him; and he is to take care that they are to be delivered as

sent according to the directions; and he is allowed for every letter *ld.*, and must answer all miscarriages through his own neglect in this kind, provided that no man be compelled to having his own letter except he please.' In 1672 Governor Lovelace of New York instituted 'a post to goe monthly' from New York to Boston and back; and in 1688 a post-office was established in Pennsylvania by the celebrated William Penn. In 1692 Thomas Neal was appointed by letters-patent postmaster-general, with authority to erect post-offices throughout the American colonies; and the same year a post-office was established in New York. In 1693 the postal system was organized by a Scotchman, named Duncan Campbell. In the early part of the last century the mail was conveyed twice a month in stage-coaches between Boston, New York, and Philadelphia; and from New York to Albany by a foot-post once a month. A general post-office was established in Virginia in 1782, with a sub-office in each county. The celebrated Benjamin Franklin was appointed postmaster at Philadelphia in 1737, and in 1753 postmaster-general to the American colonies, an office which he continued to hold till 1774, when he was dismissed by the British government. Numerous improvements were made during his management. The following are the principal postal regulations in the Union as revised under act of March 3, 1885. All mail matter is divided into four classes: The first class includes letters, post-cards, and anything closed against inspection, or containing writing not allowed as an accompaniment to printed matter: postage, 2 cents each oz. or fraction thereof; post-cards, 1 cent; registered letters, 10 cents in addition to postage. Second class matter includes all newspapers, periodicals, or matter exclusively in print, and issued at stated intervals, as frequently as four times a year from a known office of publication: postage, 1 cent per 4 oz. or fraction thereof. Mail matter of the third class includes books, transient newspapers and periodicals, circulars, and other matter wholly in print, legal and commercial papers filled out in writing, proof-sheets and copy accompanying the same: postage, 1 cent for each 2 oz. or fractional part thereof (manuscript unaccompanied by proof-sheets charged letter rates); limit of weight, 4 lbs. each package. The fourth class embraces merchandise and all matter not included in the other three classes which is not liable to injure the mail matter: postage, 1 cent per oz. or fraction thereof; limit of weight, 4 lbs. Prepayment of postage by stamps for all classes of matter is required. The free delivery of mail matter at the residences of the people desiring it is required by law in every city of 50,000 or more population, and may be established at every place not inhabited by less than 20,000.

In most of the Central and South American states the postal system is as yet far from being well organized, though a somewhat better state of matters prevails in Chili, Mexico, the Argentine Republic, and Brazil, in each of which there is also a system of state telegraphs. In Asia the postal service is carried on for the most part by agencies of European states, which in the territories directly under their administration have adopted postal systems of greater or less completeness. In India there were, in 1900, 30,645 post-offices and letter-boxes, as compared with only 753 in the year 1856. The revenue for the year amounted to 1,96,24,722 rupees, or £1,308,315, and the expenditure came to 1,77,33,705 rupees or £1,182,247. In China a series of post-carts and runners exists for conveying correspondence. Japan has a postal service modelled on the European systems, and in 1900-1901 the number of postal packets of all kinds carried was 768,247,275. Even in

the backward and semi-barbarous empire of Morocco there are now the beginnings of a postal organization.

POST-OFFICE INSURANCE. This department of the post-office, the duties of which include the issuing of government annuities as well as of life-assurance policies, was first fully organized in 1865. Annuities, either immediate or deferred, from £1 up to the amount of £100, payable half-yearly, may be purchased for any person of five years of age and upwards, and the persons obtaining such annuities have direct government security for the payment of the money. The sum payable for an annuity varies of course with the amount of the annuity, and the age and the sex of the person on whose life it is to be paid. Deferred annuities may be purchased either by a single payment or by periodical payments terminating at the time when the annuity becomes payable. By paying higher premiums the person on whose life the annuity depends may secure the repayment to his or her representatives of all the premiums paid up to his or her death, if that event should take place before the annuity becomes due. A similar provision is made with regard to monthly allowances. Policies of insurance for sums not less than £5, nor more than £100, may be issued to any person between the ages of fourteen and sixty-five, and the premiums may be paid by yearly, half-yearly, quarterly, monthly, or fortnightly instalments, provided that no payment be less than 1s. Annuities and insurance policies may be obtained from any post-office throughout the kingdom, the postmaster of which is authorized to issue them. The number of life assurances effected by the Post-Office in 1900 was 677, of a total value of £35,512; of immediate annuity contracts 2258 for £49,893; of deferred annuities 137 for £2722. The total number of insurances in existence on 31st Dec., 1900, was 12,073 for £729,787. Complete tables of the premiums payable in this department are sold by the government printers, Messrs. Eyre and Spottiswoode, for 5d., and may be seen without charge at any of the local post-offices.

POST-OFFICE SAVINGS-BANKS. See **BANK.**

POSTULATE (from *postulo*, to demand), in mathematics, a problem which it is self-evident can be solved; as, for example, to draw a line about a point so that every part of the line shall be at an equal distance from the point.

POSTULATION, in canon law, an appeal to an ecclesiastical superior to remove a disability by which any one who has been appointed to a benefice is prevented from accepting it. The term was formerly also applied to the method by which a bishop was transferred from one see to another. The canon law declared that a person once elected could not be elected again; and when an electoral college desired the bishop of another see to fill a vacancy in their own see, they petitioned the bishop to make the change, and if he consented he was translated. No postulation could be made unless the electoral college were unanimous, while in the case of an election a majority was sufficient.

POSTURES, in the ecclesiastical sense of the word, the attitudes assumed in worship, especially in prayer. Among the early Christians kneeling seems to have been the ordinary posture in prayer, except in Easter-time and on Sundays, when those engaged in this exercise stood. In the ordination of sub-deacons, deacons, and priests in the Roman Catholic Church the prostrate attitude is assumed by those undergoing the ordinance. In the same church public prostration is sometimes also required of penitents, that is, those subjected to penance.

POTAMOGETON, a genus of plants belonging to the natural order Naiadaceæ. It has a perfect

flower, a four-pointed perianth, four sessile anthers, four ovaries, and four drupes or nuts. All the species are water-plants, and often present as beautiful an appearance in clear streams and ponds as the fuci do in the sea. They protect the spawn of fish, and harbour innumerable aquatic animals, while their roots and seeds afford food to water-birds.

POTASH, or POTASSA, derives its name from *ashes*, and the pots (called *potash kettles*) in which the lixivium from which it is obtained is boiled down. Some of its old names were *vegetable alkali*, *salt of tartar*, and *alkali of nitre*. The process employed in the arts for obtaining potash is the following:—The ley of vegetable ashes is mixed with quicklime and boiled down in iron pots, and the residuum ignited; the substance remaining after ignition is common potash. Herbaceous vegetables yield more than trees; in trees, the branches yield more than the body, the small branches more than the large, and the leaves most of all. To prepare pure potash from the impure commercial article, common potash is boiled with twice its weight of quicklime for a few hours in abundance of water—the precipitate is separated, and the liquid is boiled down to the consistence of a syrup; after which an equal bulk of strong alcohol is added, and the mixture is allowed to stand some time in a closed vessel. Some solid matter will collect at the bottom of the vessel, above which will appear a stratum of watery liquor containing several salts in solution; while the alcohol occupies the top, and is coloured dark red. This last is separated from the fluid below by decantation, and is evaporated to dryness in a silver basin. The dry substance is hydrate of potash, or caustic potash, KHO. It is solid, white, and extremely caustic. In minute quantities it changes the purple of violets and cabbage to green, reddened litmus to purple, and yellow turmeric to reddish-brown. It rapidly attracts moisture from the air, and becomes semi-fluid. It is fusible at a heat of 300°, and is volatilized at low ignition. It is used in surgery under the name of *lapis infernalis* or *lapis causticus*. In chemistry it is very extensively employed, both in manufactures and as an agent in analysis. It is the basis of the common soft soaps, for which purpose, however, it is not used in its pure state. Potash is also manufactured from the ashes of marine plants. The plants are burned in large heaps, and the residue, called *kelp*, is repeatedly lixiviated with water; from this solution the potash is obtained by evaporation. Salt springs also yield this substance, which is likewise obtained in large quantity from the mineral deposits of Stassfurt, near Magdeburg. The name potash is applied not only to the hydrate of potassium, but also, and more frequently in commerce, to the carbonate of the same metal.

Decomposition of Potash.—If a thin piece of solid hydrate of potash be placed between two discs of platinum, connected with the extremities of a voltaic apparatus of 200 double plates, 4 inches square, it will soon undergo fusion, oxygen will separate at the positive surface, and small metallic globules will appear at the negative surface, which are the basis of potash. The metal was named *potassium* by Sir H. Davy, who discovered this fact in 1807. Other and more convenient methods have been devised for obtaining it. That invented by Messieurs Gay-Lussac and Thénard consists in heating potash to whiteness in contact with turnings of iron, the air being excluded. The process of Brunner, as improved by Maresca and Donné, consists in calcining crude tartar (acid tartrate of potassium) in a covered vessel so long as vapours are given off. The mass, which contains a mixture of charcoal and carbonate of potassium, is now introduced into an iron bottle

connected by a short iron tube a few inches in length with a receiver. The receiver consists of two pieces of wrought-iron 12 inches long and 5 inches wide, clasped together so as to form a shallow box $\frac{1}{2}$ inch deep. The receiver is open at both ends. On heating the iron bottle to a high point fumes of potassium begin to appear at the mouth of the tube; the receiver is now adjusted to the tube, and in it the metal is condensed. During the operation fumes of carbonic oxide are evolved, which are very liable to combine with the potassium and so to form a very explosive substance. To guard against the formation of this compound, the iron tube connecting the bottle with the receiver must be kept very hot. As soon as a sufficient quantity of potassium has condensed the receiver is removed, plunged beneath the surface of rectified naphtha, and when quite cold the potassium is removed. As thus obtained the metal is not pure; it must be again distilled.

Potassium is possessed of the following properties: It is lighter than water, its specific gravity being only 0.86. At common temperatures it is solid, soft, and easily moulded by the fingers. At 150° it fuses, and at a heat a little below redness it rises in vapour. It is opaque. When freshly cut its colour is bright silver-white; but it becomes tarnished on a moment's exposure to the air. To preserve it unchanged it must be kept under naphtha or oil of copaiha. It conducts electricity, like the common metals. When thrown upon water it decomposes that liquid with evolution of hydrogen, which burns with a pale violet flame, owing to the presence in it of potash vapour. The water becomes a solution of potash. When moderately heated in the air it inflames, burns with a red light, and throws off alkaline fumes. Placed in chlorine, it burns with great brilliancy. On all fluids containing much water, oxygen, or chlorine it readily acts. The *protoxide* (K_2O) is obtained by the action of dry air, free from carbonic acid, upon the metal in thin slices. When potassium burns in open air, or in oxygen gas, it is converted into an orange-coloured substance, which is the *peroxide* of potassium, K_2O_2 .

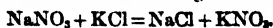
Chloride of potassium (KCl) has a saline and bitter taste. It occurs in large deposits at Stassfurt, both separate as sylvine and in combination with magnesium chloride as carnallite; and it is also a normal constituent of sea-water and of several animal and vegetable substances. The chloride forms the starting-point in the manufacture of most potassium compounds. The *bromide* of potash (KBr) is used in medicines and photography, and is prepared by the action of iron bromide on potassium carbonate. *Iodide of potassium* (KI) is formed when potassium is heated in contact with iodine. A more practical method is to decompose ferroso-ferric iodide with the carbonate of potash; or to dissolve iodine in caustic potash or potassium carbonate solution, evaporate to dryness, and calcine the mixture of iodide and iodate with charcoal. It dissolves in strong alcohol; and the solution, when gently evaporated, yields small colourless cubic crystals of iodide of potassium. Potassium iodide is of very great value in medicine, and is also used in photography. Potassium forms several *sulphides*, but the most important is that prepared by heating the carbonate with sulphur. This body, known as *liver of sulphur*, is used in medicine and also in horticulture. A *phosphide* and a *fluoride* are also known.

Carbonate of potassium (K_2CO_3) is the *pearl-ash* of commerce. It is manufactured in several ways, but the most important source now is potassium chloride, from which it is obtained by a process substantially the same as the Leblanc soda process, namely, by the action, in two stages, of sulphuric acid, charcoal,

and calcium carbonate. It is also made from wood-ashes. Its taste is acrid, and it has an alkaline reaction. It is decomposed by acids, carbonic acid being disengaged with effervescence. Potassium carbonate is important as a source of other potassium compounds, and also on account of its application in the manufacture of glass and soap.

Bi-carbonate of potassium (KHCO_3) may be obtained by exposing a solution of the carbonate to the air for some time, carbonic acid being imbibed from the atmosphere, and white rhombic crystals being deposited; or it is formed more directly by passing a current of carbonic acid gas through a solution of the carbonate of such a strength that crystals form spontaneously. They are much less soluble in water than the normal carbonate. It is much used for medicinal purposes.

Nitrate of potassium, nitre, or saltpetre (KNO_3), is a white, translucent, or transparent salt, usually crystallized in long, six-sided prisms with dihedral summits. Its taste is penetrating. It dissolves readily in cold water, and still more readily in boiling water, but it is insoluble in alcohol. On being exposed to a gentle heat it fuses; and in this state, being poured into moulds, so as to form little round cakes or balls, it is called *sal prunella* or *crystal mineral*. Further heating causes it to lose some oxygen, so that nitrite of potassium (KNO_2) is formed. Nitre powerfully promotes the combustion of inflammable substances. Two or three parts mixed with one of charcoal, and set on fire, burn rapidly; nitrogen and carbonic acid gas are given out. Nitre is found impregnating the soil of extensive tracts in India, Persia, Egypt, and other countries, and in these regions it often forms an efflorescence on the surface of the ground. To obtain pure saltpetre this is scraped up and lixiviated with water, and the solution is then evaporated somewhat in order to cause the nitre to crystallize out. If potash be added to the solution the nitrate of calcium will be changed into nitrate of potassium, and thus a larger yield of that salt will be obtained. These extensive nitre deposits are now known to be formed by the agency of minute organisms or microbes. The production of nitre from artificially prepared beds was formerly of great importance in Sweden, Switzerland, France, and some other countries, and it is still practised to some extent. All sorts of putrefying organic rubbish are mixed with old mortar and similar materials, and formed into heaps in the open air, sheltered from rain. Stable runnings and such refuse are added to the heaps at intervals. The earth is lixiviated with water, and wood-ashes are added in order to convert the nitrates of lime and magnesia into the corresponding salt of potassium. The nitre is then separated by crystallization. Before concentrating the solution and crystallizing the nitre it is usual to add a little glue and then skim off the resultant scum, thus freeing the solution from several impurities and making it clearer. Much more important than either of these processes is the manufacture of nitre by the double decomposition of sodium nitrate, also called *Chili saltpetre* and *cubic nitre*, with potassium chloride, according to the equation:—



The commercial chloride of potash containing about eighty per cent of the salt is dissolved in water in tanks of cast-iron, copper, or wood lined with lead, each holding some 500 gallons. The solution is heated till its specific gravity is about 1.2, and then the cubic nitre, containing only about five per cent impurity, is added. The mixture is stirred for about an hour while boiling, and then the chloride of sodium is removed by evaporation and crystallization till the remaining solution has a specific gravity of about

1.5. This solution, after being freed from all sediment, is stirred while cooling, so as to cause the nitre to separate by crystallization. The separated solid is washed with cold water or a saturated solution of potassium nitrate in order to free it from the mother-liquor and from common salt. The washings and the mother-liquor are utilized as a solvent for the potassium chloride in a future repetition of the process. The nitre is made practically pure by means of recrystallization. If magnesium chloride is present as an impurity in the potassium chloride, the magnesium is usually removed by adding soda-ash before the treatment with cubic nitre. Nitre is a substance of great importance for many purposes. It is one of the constituents of gunpowder, and is also used in making other explosives. In the manufacture of sulphuric and nitric acids and in some other operations it has been replaced by the corresponding salt of sodium, but it is still used in certain metallurgical and analytical processes. Nitre also finds application in pyrotechnics, in the manufacture of matches, in the curing of meat, and to some extent in medicine. *Touch-paper* is paper soaked in a solution of nitre and afterwards dried.

Sulphate of potassium (K_2SO_4) is formed by the action of sulphuric acid on potash, chloride of potash, or carbonate of potash. It crystallizes in six-sided prisms, with pyramidal terminations. It is now often made from *kainite* (K_2SO_4 , MgSO_4 , MgCl_2 , $6\text{H}_2\text{O}$), a substance found in the Stassfurt deposits. This body when heated with water under pressure yields a double sulphate of potassium and magnesium, which may be crystallized out and converted into another double sulphate. From this latter body potassium sulphate is made by the action of a solution of chloride of potash. Sulphate of potash is used as a fertilizer, and in one of the processes for making potassium carbonate. *Kainite* is also used as a fertilizer. *Bi-sulphate of potassium* (KHSO_4) is the salt remaining after the decomposition of nitre by sulphuric acid. It is more soluble than the normal sulphate.

Chromate of potassium (K_2CrO_4) is soluble in water, and by evaporation affords yellow prismatic crystals, which are not changed by exposure to the air. The *bichromate* of potash ($\text{K}_2\text{Cr}_2\text{O}_7$) is much more important than the normal chromate. It crystallizes in anhydrous, red, square tables, with a very bitter taste, which decompose when strongly heated into the normal chromate and chromic sesquioxide. It is manufactured from chrome iron ore (chromite) by roasting it with potash, lixiviating with water, and then adding sulphuric acid to convert the normal chromate so formed into the bichromate. Recrystallization is adopted in order to purify the salt. Potassium bichromate is used in making chrome pigments, as a bleaching agent for oils, fats, &c., as an oxidizing agent in dyeing and calico-printing, as a mordant, in the making of safety-matches, in the carbon process of photography, in a special tanning process, and for other purposes.

Chlorate of potassium (KClO_3) may be formed by receiving chlorine as it is formed into a solution of potash. It is now always made by Liebig's process, which may be briefly explained thus. Chlorine is passed into milk of lime to saturation at or above a temperature of 100°C ., the result being the formation of the chloride and chlorate of calcium. The latter of these is then decomposed by chloride of potash, and potassium chlorate is formed. The first product is purified by recrystallization, and the salt may be sold either as crystals or in the ground form. A modification of the above process, consisting in the substitution of magnesia for lime, has been adopted with advantage. The crystals are shining,

hexahedral laminae, or rhomboidal plates. Its taste is cooling and disagreeable. The purest oxygen is obtained from this salt by exposing it to a gentle heat, but manganese dioxide is usually added to facilitate the reaction. Its effects upon inflammable substances are very powerful. Two grains, rubbed into a powder in a mortar, and mingled with one grain of sulphur, give a loud detonation when struck upon an anvil with a hammer. Five grains of the salt, mixed in the same manner with $2\frac{1}{2}$ of charcoal, will be inflamed by strong trituration. If a little sugar be mixed with half its weight of the powdered chlorate, and a little strong sulphuric acid poured on it, a sudden inflammation will ensue. If to 1 grain of the salt in a mortar we add $\frac{1}{2}$ grain of phosphorus, and communicate to it a slight trituration, it will detonate with great violence, and attended with some hazard to the operator from the jets of burning phosphorus. This salt is employed in the manufacture of lucifer matches, in pyrotechnics, for fuses and certain explosive combinations, in dyeing and calico-printing, in the alizarin industry, and in medicine.

The cyanide of potassium (KCN) forms colourless cubic crystals very soluble in water, the solution being strongly alkaline in its action on litmus-paper. It is made by fusing yellow prussiate of potash with potassium carbonate till carbon-dioxide ceases to come off. The metallic iron formed sinks to the bottom, and the remaining mixture of cyanide and cyanate of potash is run off. Powdered charcoal may be used to reduce much of the cyanate to cyanide, but if the presence of cyanate is objectionable for any special purpose, it may be thoroughly reduced by using zinc or sodium, or the cyanide may be removed by means of alcohol, carbon disulphide, or acetone. Cyan-salt is an important mixture of the cyanides of sodium and potassium, obtained by fusing the yellow prussiate with sodium carbonate. Potassium cyanide is used as a flux and for the formation of double cyanides in electroplating, but its chief use is in the cyanide process to which low-grade ores of gold are subjected. *Potassium ferrocyanide*, or *yellow prussiate of potash* ($K_4Fe(CN)_6 \cdot 3H_2O$), occurs in large crystals, which, unlike those of the previous salt, are non-poisonous. It is made by fusing together potassium carbonate, iron borings, and nitrogenous organic matter, and is used in dyeing, calico-printing, the case-hardening of iron, for making Prussian blue and the other cyanides of potassium, and for other purposes. *Potassium ferricyanide*, or *red prussiate of potash* ($K_3Fe(CN)_6$), is commonly made by passing chlorine gas into a solution of the yellow prussiate until ferric chloride ceases to form a precipitate, but other methods are also in use. The ferricyanide crystallizes in red prisms, but its solution has a yellow colour. It is used in calico-printing and for other purposes. The *sulphocyanide* of potassium (KSCN) is used in dyeing.

Potassium silicate forms an essential constituent of many soluble or water glasses. It is made by fusing powdered quartz or infusorial earth with the hydrate or carbonate of potash. It has many uses, as in soap manufacture, fresco-painting, calico-printing, and the manufacture of artificial stone.

Potassium manganate (K_2MnO_4) is obtained by calcining an intimate mixture of caustic potash and manganese dioxide at a red heat with free access of air. The *permanganate* of potash ($KMnO_4$) is obtained from the manganate by the action of sulphuric acid, chlorine, or carbon dioxide. It crystallizes in purple prisms, and the solution acts as a powerful oxidizing agent. It is used as a disinfectant (as, for instance, in the well-known Condy's Fluid), for purifying ammonia and carbon dioxide gases, in bleaching and dyeing, for medical purposes, &c.

POTASSIUM. See POTASH.

POTATO (*Solanum tuberosum*), a plant belonging to the natural order Solanaceae, which contains tobacco, the nightshade, and other narcotic plants. Mankind owe this invaluable esculent to the temperate regions of western South America, where it still grows wild, and where it was cultivated long previous to its introduction into Europe. The wild plant grows chiefly in mountainous regions or in steep rocky districts near the sea, and produces only small, tasteless, watery tubers; but, on the other hand, has sweet-smelling flowers; and although the flowers of the modern cultivated plant are scentless, Clusius, among the first to write of the potato, describing in 1601 the first cultivated potatoes in Belgium, praises the sweet smell of their blossoms. The potato was introduced into Europe for the first time by the Spaniards after the conquest of Peru, by whom it was spread over the Netherlands, Burgundy, and Italy before the middle of the sixteenth century. In Germany it is first heard of as a rarity in the time of Charles V. Sir John Hawkins and Sir Francis Drake are both said to have brought the plant from the New World, but it was apparently the sweet-potato that they introduced; and a servant or agent of Sir Walter Raleigh, whom he sent out to Virginia, was the first to make our potato well known in England. This person, whose name was Harriot, in his Brief and True Report of Virginia (1588), gave an account of both the potato and tobacco, and Raleigh planted potatoes brought home by Harriot in his garden at Youghal, and thus introduced the plant into Ireland as well as into England. In 1596 potatoes and tobacco were both growing in Lord Burghley's garden in the Strand. Shakspeare speaks familiarly of 'potatoes', but it was undoubtedly the sweet-potato that he meant. Although the potato was tolerably widely distributed on the continent of Europe by the end of the sixteenth century, it was cultivated more as an article of curiosity than as an article of food, and Ireland was the country in which it was first cultivated on a large scale as a means of subsistence. The Royal Society in 1663 advocated its wider cultivation in England, and it was first cultivated on an extensive scale in Lancashire about 1684, and gradually spread over England and Scotland. In the course of the eighteenth century it became a favourite article of food with the poorer classes in Germany; but in France there existed so violent a prejudice against it that it did not come into use until the reign of Louis XVI., towards the close of the eighteenth century. Now the potato is almost universally cultivated in temperate regions and within the tropics, and even within the Arctic circle (in the north of Norway, for instance); and it seems to be adapted to all exposures and almost every soil. The potato has added millions to the population of Europe, and till the disease appeared had rendered famines less frequent.

The potato tuber is the underground stem of the plant, rounded or oblong, almost always white internally, but differing in different varieties in the colour of the skin, which is white, purple, red, or yellow, or variegated in some manner. The stems are angular, herbaceous, and from $1\frac{1}{2}$ to 2 feet high. The leaves are pinnate, composed of five or seven lanceolate-oval leaflets, having lesser ones between them. The flowers are pretty large, numerous, and disposed in corymbs upon long peduncles, which are inserted opposite to the superior leaves; their colour is violet, bluish, reddish, or whitish. The fruit is of moderate size, and reddish-brown when ripe. The potato succeeds best in a light sandy loam containing a certain proportion of vegetable matter. The usual mode of planting is by cutting the tubers in pieces, reserving

one eye or bud to each piece, and covering these with earth. It used to be a more certain crop than any other, having little to fear from storms or hail, or even from long droughts or continued rains. It is mostly planted in rows, with plenty of farmyard or other manure, and raised drills are formed about the stems. The varieties of the potato are very numerous, differing in the time of ripening, in their form, size, colour, and quality; and in general every district has its peculiar or favourite ones, and their names are quite arbitrary or local. In 1842 161 varieties of the potato were enumerated as having been previously or as being still cultivated in Europe, and the most of them in Great Britain. At present as many as 500 varieties have been exhibited. In respect of shape, potatoes are classified in three well-marked groups, namely, *round*, *oval*, and *kidney*. According to time of ripening, they are usually grouped as *early* (e.g. Early Regent, Snowdrop, and Ashleaf); *mid-season* (e.g. Abundance, Windsor Castle, and White Elephant); and *late* or *main-crop* (e.g. Magnum Bonum, Stourbridge Glory, &c.). Some varieties degenerate and others improve by removal to another district. New ones are readily procured by sowing the seeds, which, with care, will produce tubers the third year, and a full crop the fourth. In addition to the culinary uses of potatoes, bread may be made by mixing with them a nearly equal portion of wheat-flour; and also a kind of cheese by mixing with curd. Alcohol is very extensively distilled from the potato in Europe. Starch may be made by the simple process of scraping them in water and thoroughly washing the pulp, when the starch settles to the bottom in a dense sediment. This starch is not only used for the same purposes as that prepared from wheat, but also as a size, which does not putrefy like that produced from animal substances, and has no disagreeable smell. Potatoes are also much used as food for cattle. In some localities early potatoes are obtained as a field-crop by a method of forcing, the tubers being made to sprout indoors before planting out. Large quantities are now brought to Britain, before the home crops are ripe, from the Channel Islands, Malta, &c.

Like all plants that are extensively cultivated, and under very different circumstances of soil, climate, and artificial treatment, potatoes are extremely subject to disease. The most formidable of the diseases to which the potato was liable before the appearance of the dry and wet rot and the potato murrain, or what is usually spoken of as the 'potato disease', were curl and scab. The principal feature of the former of these two diseases, that from which it gets its name, is the curling of the shoots soon after their first appearance. After this symptom has manifested itself the shoots make little progress, and sometimes disappear altogether. The plants affected by it produce no tubers, or only a few minute ones, which are hard and unfit for food. The disease was first generally noticed in the year 1764, and was very prevalent in England towards the end of the eighteenth century. It is attributed to the gradual weakening of the plant by constant propagation from cuttings instead of from seed. The scab is a disease which attacks the tubers, which become covered with brown excrescences on the outside, while underneath the skin are various fungi. The first detailed description of the disease known as *dry-rot* is to be found in a memoir published by Martius at Munich in 1842. The disease had been prevalent in Germany since 1830, committing great ravages there, especially in the south. It is characterized by a hardening of the tissues, which are completely gorged with mycelium (the vegetative part of fungi), which is often very closely compacted, and which at length bursts

forth in the form of little white cushion-shaped tufts loaded with fructification. The whole tuber sometimes becomes so hard as to make it difficult to break it even with repeated blows of a hammer. It is constantly accompanied by a fungus, called by Martius *Fusisporium solani*. In the disease called *wet-rot* the potato is affected much in the same way as by the dry-rot; but the tubers, instead of becoming hard and dry, are soft. The causes of wet-rot are not yet exactly known, but it is certain that various bacteria and fungi, among the latter *Rhizoctonia solani*, are concerned in the process of decay. It seems also proved that the part played by bacteria in this disease is an important one. The potato murrain, or potato disease *par excellence*, was first observed in a serious form in Great Britain in the year 1845, though there were slight indications of it one or two years before both in Britain and on the continent of Europe. In the year 1844 it was most disastrous in America, and it appears to have been known for ages on the western coast of that continent. Usually the first sign of disease is the appearance of brown patches upon the haulms and leaves. In some early varieties of potato, such as the Ashleaf, there does not appear in many instances to be any previous disease of the leaves; but then in these cases the tubers are not diseased till the prevalence of the disease in other later varieties, and inasmuch as the tubers are merely underground shoots, it does not seem very surprising that though the leaves had perished before the season in which those of other varieties were first attacked, the tubers should afterwards become so. The first spots indicative of disease appear upon the leaves towards the commencement of autumn, and when carefully examined are found to be surrounded by a ring of a paler colour than the body of the spots, and the whole of this outer ring is frosted with a fungus called *Phytophthora infestans*, which is now generally regarded as the immediate cause of the disease. If the weather be dry the progress of the disease is slow, but if a moist warm day supervene it will be found on carefully examining the brown specks at different hours of the day that the mould spreads with great rapidity, destroying all before it, or converting the green cells into brown. The separate spots soon become confluent; the evil extends to the stems, and if the weather be favourable to its progress the whole may become in a few days corrupt or putrid. The same parasitic fungus that is found on potatoes affected by the potato murrain has been found also within the berries of diseased tomatoes and on the leaves of a few allied plants, but not on plants of any other family. Of the plans adopted for mitigating the potato disease, or preventing it from affecting the tubers, one of the simplest consists in cutting off the potato tops as soon as the first rumour of its approach is heard. If the leaves are already spotted before this is done, it is rarely effectual. But few farmers can be prevailed upon to cut the haulms as soon as the disease manifests itself in neighbouring localities, because, in the first place, their crops may in a great measure escape, and they would be greatly diminished in weight if this plan were resorted to; and in the second place, the starch-mills may afford a market for diseased potatoes, since the disease does not affect the quality of the starch that may be obtained from the tubers. Another successful plan consists in laying down the potato-stalks on each side of the drill, and covering the whole of them up with earth except the very tips of the haulm. A preparation of sulphate of copper and quicklime is now much used as a protective as well as a curative dressing. As a means of fortifying potatoes against attacks of the disease, it is by some theorists and cultivators

thought advisable to avoid all undue forcing of the crop by a too rich and abundant application of ammoniacal manures.

POTATO-DIGGER, **POTATO-RAISER**, an agricultural implement used for digging up potatoes. Various forms of this machine are in use, the simplest merely depositing the tubers on the surface. See **AGRICULTURE**.

POTEMKIN, **GREGORY ALEXANDROVICH**, the most famous of the favourites of the Empress Catharine II., born near Smolensk, in 1736; died in Besarabia in 1791. He was descended from an ancient Polish family, and while still young obtained an ensigncy in the horse-guards. Soon after the accession of Catharine he attracted the attention of his sovereign, who appointed him colonel and gentleman of the chamber. In the war against the Turks in 1771-72 he served under Romanzoff, and acquitted himself so well that he was rewarded with the rank of lieutenant-general. Soon after he gained the entire confidence of Catharine, and became her avowed favourite. From 1776, after he had managed to supplant the brothers Orloff, his chief rivals for the favour of the empress, till his death, a period of more than fifteen years, he exercised a boundless sway over Catharine and the destinies of the empire. In 1783 he suppressed the nominally independent khanate of the Crimea, and annexed it to Russia. This, however, was not effected without resistance, to overcome which Potemkin resorted without scruple to the most sanguinary measures. In order to secure his conquest he then created a larger army than Russia had hitherto possessed. In 1787, being desirous of expelling the Turks from Europe, he stirred up a new war, in the course of which, at the head of the main body of the Russian army, he took Oczakoff by storm (1788). In the following year (1789) he took Bender, but as the finances of Russia were by this time exhausted Catharine was desirous of peace. Potemkin, however, was resolved on conquering Constantinople, and resisted the proposal to enter on negotiations with the enemy. Seeing his views disregarded he started for St. Petersburg, hoping by his presence to win over the empress to his side (March, 1791); but Catharine took advantage of his departure from the scene of action to send plenary powers to Prince Repnin, who, after once more defeating the Turks, dictated a peace, the preliminaries of which he signed. Meanwhile he was entertained by Catharine with splendid festivals and loaded with gifts, but hearing of the steps that had been taken at the seat of war, he at once repaired thither, vowing to undo the work of his substitute. He reached Jassy, but afterwards set out from thence to Nicolaieff, with what object is not known, and died on his journey thither. His body was carried to Cherson, where the empress appropriated 100,000 roubles for the erection of a monument to him, which was never completed. Afterwards, the Emperor Paul caused the corpse of his mother's favourite to be taken from its coffin, and thrown into the ditch of the fortification. The Emperor Alexander at last awarded his bones a decent burial. Satiated even to disgust with sensual pleasure, Potemkin denied himself nothing, and satisfied every passing whim by a prodigal waste of the money of the state, and a wanton sacrifice of the lives of others. Though the empress denied him nothing, and the sums of money which she expended on him exceeded all belief, still he was mean enough to appropriate to himself the money intrusted to him for other purposes, and even to forge orders on the treasury, in the name of the empress, in order to obtain for himself the money which was necessary for supplying the wants of the state. Potemkin also

suffered himself to be purchased by foreign powers. While possessed of incredible wealth, and throwing away the largest sums at the gaming table, or in the gratification of his whims, he did not pay the bills of those who furnished his ordinary supplies. Those tradesmen considered themselves ruined who received orders to furnish goods to Potemkin.

POTENTIAL, a function which has been of marvellous power in developing the mathematical theories of gravitation, electricity, magnetism, fluid motion, the conduction of heat, &c. It was first introduced for gravitation by Laplace, but the name was first given to it by Green in his essay *On the Application of Mathematical Analysis to Electricity*. Green may be said to have created the theory of potential as we now have it. His work was neglected till 1846, and before that time most of its important theorems had been re-discovered by Thomson, Gauss, and others. Thomson brought Green's essay before the world, and employed the principle in solving a large number of difficult problems. The mutual potential energy of two repelling bodies in any relative position is the amount of work obtainable from their mutual repulsion by allowing them to separate to an infinite distance asunder. The potential at any point, due to any attracting or repelling body, or distribution of matter (quantities of electricity, magnetism, &c., enter into formulæ like quantities of ordinary matter), is the mutual potential energy between it and a unit of matter placed at that point. It is convenient to change the sign for attractions, so that the gravitation potential at any point, due to any mass, is the quantity of work required to remove unit of matter from that point to an infinite distance. The importance of this function in electricity is now acknowledged to be too great for it to be ignored by even unmathematical physicists, and we shall give a few necessary definitions and explanations. The 'potential' at any point in the neighbourhood of or within an electrified body is the quantity of work that would be required to bring a unit of positive electricity from an infinite distance to that point, if the given distribution of electricity remain unaltered. The 'difference of potential' between two points is therefore the quantity of work required to move a unit of electricity from one point to the other. This difference of potential between two points has also been called the 'electromotive force' between them; it has been described more vaguely as that which tends to produce a transference of electricity from one point to the other. (See **OHM'S LAW**.) Contact, the motions of magnets and of currents of electricity, &c., create differences of potential, and give rise to the flow of electricity. There is, of course, a unit difference of potential (or there is an action of unit electromotive force) between two points, if a unit of work is spent in transferring a unit quantity of electricity from one point to the other. The 'potential of a point' is an expression in common use; it means the difference of potential (the electromotive force) between the point and the earth. A surface at every point of which the potential has the same value is called an 'equipotential surface.' At any point on such a surface the force which would act upon an electrified particle is normal to the surface; in fact all 'lines of force' (which see) cut such a surface normally. When a current is passing along a wire or other conductor the potential varies from point to point, and it is such that the difference of potential between A and B is to the difference of potential between C and D as the resistance between A and B is to the resistance between C and D. This is merely a deduction from Ohm's law; it is the principle of the Wheatstone's bridge. See *Everett's Natural Philosophy*, Thomson and Tait, *Clerk Maxwell's Electricity*.

POTENTIAL ENERGY, that part of the energy of a system of bodies which is due to their relative position, and which is equal to the work which would be done by the various forces acting on the system if the bodies were to yield to them. Helmholtz called this 'the sum of the tensions,' Thomson called it 'statical energy' (the term 'energy' was first used by Young, in a scientific sense, to denote power to do work); but Rankine's name, 'potential energy,' significant of the energy which the system has the power to acquire, but which it is not possessed of, is that which has been universally adopted. If a stone is at a certain height above the earth's surface the potential energy of the system consisting of the earth and stone, in virtue of the force of gravity, is the work which might be done by the falling of the stone to the surface of the earth. This work is quite definite in amount, the weight of the stone and its distance from the earth being known. See **PRINCIPLE OF THE CONSERVATION OF ENERGY**.

POTENTIAL MOOD, that mood of a verb which expresses an action, event, or circumstance as merely possible. In English this mood is formed by means of the auxiliary *may*. In Sanskrit there is an inflected mood bearing this name, and having the function stated.

POTENTILLA, a genus of plants of the natural order Rosaceæ, with a concave calyx four to five parted, four to five petals, numerous stamens, a lateral or nearly terminal style, and flowers white or yellow, seldom red. The principal species are:—1. *P. reptans*, or creeping cinquefoil, a common British plant, with large bright yellow flowers. It is sometimes used as a febrifuge.—2. *P. tormentilla*, or tormentil, which has astringent roots, used for tanning in the Faroe Isles, the Orkneys, and Hebrides. They also yield a red dye. In some parts they are given to pigs.—3. *P. anserina*, or silverweed, whose leaves are greedily devoured by geese, and sometimes used as pot-herbs, and whose roots are eaten both by hogs and men. Two species are used in Siberia as substitutes for tea, and several of them make handsome garden plants.

POTENZA, a province in the kingdom of Italy, in Naples, bounded on the north by Foggia, on the east by Bari and Lecce, on the south by the Gulf of Taranto and the province of Cosenza, and on the west by the Mediterranean and the province of Salerno. It corresponds pretty closely with the ancient Lucania, which, however, extended to the west coast throughout its whole length. The chief productions of the province are maize, hemp, wine, silk, cotton. Potenza forms the whole of the department (*compartimento territoriale*). Area of the province, 3845 square miles; pop in 1901, 490,000.

POTENZA, a town in Italy, Naples, capital of the province of same name, on a hill of the Apennines 85 miles S.E. of Naples. It is near the site of the ancient Potentia, from which it has its name. It is walled, and on the whole very indifferently built, but contains a number of handsome buildings, among others a fine cathedral in the Doric style. Potenza is the see of a bishop, and possesses a civil and a criminal court, a seminary, and royal college. It has suffered much from earthquakes. The most disastrous of recent times was that of 1857. Pop. (1881), 17,978.

POTHIER, ROBERT JOSEPH, a celebrated French jurist, born at Orleans, January 9, 1699; died there March 2, 1772. His digest of the maxims and principles of the Roman law contained in Justinian's pandects under the title of Pandectæ Justinianæ in novum Ordinem digestæ, was more highly esteemed in foreign countries than at home. Of his profound knowledge of the *droit coutumier* we have a

proof in his *Introduction à la Coutume d'Orléans*, and the commentary which accompanies it. His different treatises on various points of legal sciences are in the highest esteem. The first, which is a sort of foundation for the others, is his *Traité des Obligations*, which, as is also the case with the rest, displays a methodical mind, and is distinguished for clearness, profundity, and precision, and for its high tone of morality, which was in accordance with the character of his life. Pothier was appointed professor of French law at the University of Orleans, and appropriated the salary attached to his office for premiums to his most industrious pupils. A statue was erected to him in one of the principal public places of Orleans in 1859. The best of the older editions of his works (exclusive of the *Pandects*) is that of 1777-78 (three vols. 4to). Of this edition there have been numerous re-impressions in various forms. The latest is that of Bugnet (Paris, ten vols. 8vo, 1845-48; 2nd. ed., 1861-62).

POTI, the ancient Phasis, a town in the Russian government of Kutais in Transcaucasia, situated at the mouth of the Rion on the eastern coast of the Black Sea. After the erection of harbour works and the opening of a railway to Tiflis, Poti became a place of some importance, but its trade has been drawn away by Batoum. Pop. (1890), 5201.

POT METAL, an inferior kind of brass used for large vessels employed in the arts. Also, a kind of stained glass in which the colours are incorporated with the substance by being added while the glass is in a state of fusion.

POTOCKI, the name of an ancient Polish family, the cradle of which was the castle of Potok in the former woywodeship of Cracow, and which still has large possessions in Galicia and the Ukraine. The following are among the most distinguished members of the family:—

1. **COUNT STANISLAW FELIX**, the commander of the Polish artillery, acted an important part in the troubles of 1788. He adhered pertinaciously to the old constitution of Poland, and exerted his influence against the constitution of May 3, 1791. (See **POLAND**.) Potocki so far forgot his duty to his country as to form connections with Russia, and in May, 1792, joined with Rzewuski and Branicki in the declaration at Targowicz against the constitution. He then united himself with the Russian army, and was one of the leaders of the diet of Grodno, which abolished the constitution, and subscribed the act for the partition of the country. (See **PONIATOWSKI**.) He was thought to aspire to the crown, and received several important appointments from Catharine II. He died in 1803.

2. **COUNT IGNAZY**, his cousin, born 1751, Grand-marshal of Lithuania, united with Malachowski, Kolontay, and other patriots in support of the constitution of May 3, 1791. He also procured the declaration of the king in favour of it, and in 1792 went to Berlin for the purpose of inducing the Prussian court to protect the Poles from Russia. When the Russian troops took possession of the country Potocki fled to Dresden, and was deprived of his estates. In 1794 he returned to Warsaw to engage in the attempt of Kosciusko, and was appointed general and member of the supreme national council. After the capture of Warsaw he remained in the city, trusting to the capitulation concluded with Suvaroff, but he was arrested in December, and confined as a state prisoner in Russia until he was released by Paul in 1796. In 1806 he again engaged in public affairs, and exerted himself to effect the abolition of serfdom, and to promote the progress of education among the people. He died in 1809.

3. **COUNT STANISLAW KOSTKA**, brother of the pre-

coding, born in 1757; died in 1821. He was always faithful to the cause of his unfortunate country. He distinguished himself greatly by his eloquence in the various diets which were held between 1788 and 1792. When the king acceded to the Confederation of Targowicz, and by that false step consummated the ruin of Poland, Count Potocki retired into Austria; but he was arrested there and imprisoned in a fortress. On being restored to liberty, there being no hope of breaking the chains of his countrymen, he retired to his estate, and devoted himself to the sciences and arts. He continued to live in retirement till the creation of the Grand-duchy of Warsaw in 1807, when he returned to his native country, and as president of the council of education applied himself unremittingly to the promotion of intellectual culture among his fellow-countrymen. When Napoleon gave out that he meditated the restoration of the ancient kingdom of Poland, Potocki's talent and influence were called into action by him; and the Abbé de Pradt pays to the count a warm tribute of praise on this occasion. In 1815 Count Potocki was appointed minister for ecclesiastical affairs and public instruction, and was afterwards chosen president of the senate. He was the author of a work on eloquence, and of a Polish translation of Winckelmann's work on ancient art.

4. COUNT JAN, one of the most distinguished of Slavonic historians, born at Pikow in the Ukraine in 1761; died in Poland in 1815. At an early age he formed the resolution of clearing up the obscurity that rested on Slavonic history, and prepared himself for carrying out this resolution by a course of linguistic studies, and by travelling over the lands occupied by Slavonic nations. He also travelled extensively in other parts of Europe and in Egypt, and even visited China. His most remarkable works are: *Voyage en Turquie et en Égypte fait en 1784* (Warsaw, 1788); *Essai sur l'histoire universelle et recherches sur la Sarmatie* (Warsaw, five vols. 1788); *Histoire primitive des peuples de la Russie* (St. Petersburg, 1802); *Fragmenta historiquæ et géographiques sur la Scythie, la Sarmatie, et les Slaves* (Brunswick, four vols. 1796); *Chroniques, mémoires et recherches pour servir à l'histoire de tous les peuples slaves* (Warsaw, 1793); *Voyage de Basse-Saxe, with engravings on copper containing the antiquities of Prillwitz* (Hamburg, 1795); *Histoire des gouvernements de Volhynie, de Podolie, et de Cherson* (St. Petersburg, 1804-5). All these works are particularly valuable as collections of materials. His other works are all, like those cited, written in French. A life of Jan Potocki was published in Polish at Cracow in 1849.

POTOMAC, a river of North America, which rises in the Alleghany Mountains, and forms through its whole course the boundary between the state of Maryland and that of Virginia and West Virginia. It passes Shepherds town, Georgetown, Washington, and other places, and flows into Chesapeake Bay about 75 miles from the open sea. For about 100 miles of its lower course it forms a kind of estuary from 6 to 8 miles wide. The termination of the tide-water is at Washington, about 125 miles from the sea, and the river is navigable for the largest ships through all that distance. Above Washington there are several falls which obstruct the navigation. The scenery at the junction of the river with the Shenandoah at Harper's Ferry is remarkably picturesque. The river is 7 fathoms deep at its mouth. It abounds in excellent fish. The total length of the river is about 400 miles.

POTOSI, a city of Bolivia, in the province of the same name, lat. 19° 36' n.; lon. 65° 24' w. It was founded in 1547; the royal mint was established in

1562, and the population increased so rapidly that in 1611 it amounted to 150,000, many of whom were doubtless *mitayos* or Indians dragged thither by the system of forced labour called *mita*. The present population is only about 16,000. The city stands on an uneven site at a height of more than 13,000 feet above the sea, being thus one of the highest inhabited localities in the world. The famous silver-mines here are said to have been discovered by Diego Hualca, an Indian peasant, when pursuing wild goats. Arriving at a steep place he laid hold of a small shrub to prevent himself from falling, but the shrub being unable to support his weight was torn up by the roots, and disclosed to the hunter a rich mass of silver, lumps of which adhered to the earth that came away with the plant. Not long afterwards the discovery was made known, and the first mine was opened in 1545. From the time of the first discovery to 1864 these mines supplied, it is estimated, an amount of silver equivalent to some £600,000,000 sterling. If the smuggled silver could have been taken into account no doubt the amount would be much greater. The number of mines worked was formerly 300. A certain number are still worked, although their yield is very much less than it formerly was. The city is still one of the most important in Bolivia. It has a mint (disused), a cathedral, numerous churches, convents, and various public buildings, but has a dilapidated and unattractive appearance.

POT-POURRI (French) signifies the same as *olla podrida* (which see); also, and more generally, any sort of medley, whether it be a musical medley or a literary composition.

POTSDAM, a town in Prussia, capital of the government of the same name and of the province of Brandenburg, and the second royal residence of the kingdom, is charmingly situated in the midst of wooded hills, 17 miles south-west of Berlin, on the Havel, which here forms or is connected with several lakes or lake-like expansions. The older and main part of the town stands on the right bank of the Havel, which is crossed here by a bridge 640 feet long besides a railway bridge. The suburbs extend in various directions (they may now be reached by tramways and steamers), and the whole forms one of the handsomest towns in Germany. Of the squares the most deserving of notice are the Old Market, with an obelisk of white and red marble 75 feet high and medallion busts of the great elector and the first three kings of Prussia, the Wilhelmplatz and the Lustgarten, laid out in beautiful walks and adorned with pavilions, statues, and fountains. The principal edifices are the Garrison Church, containing the tombs of William I. and Frederick the Great; the Nikolai Church or Church of St. Nicholas, with a lofty dome, the French Church, built after the model of the Pantheon at Rome; the town-house; and the royal palace, dating in its present form from 1750, and interesting from its associations with and relics of Frederick the Great. Educational and benevolent institutions are numerous. The industries include silk, chemicals, wax-cloth, sugar-refining, brewing, saddlery, tobacco, &c. There is also a government manufactory of arms. Potsdam is the see of a bishop, has a provincial, high, and numerous other courts and offices, and various literary and other societies. Immediately to the west, outside the Brandenburg Gate (a triumphal arch in the style of Trajan's arch at Rome), commence the gardens of the Palace of Sans Souci, laid out, under the direction of Frederick the Great, in stiff French formal taste, with alleys, cut hedges, statues, basins, &c. The palace itself stands at the extremity of a broad avenue, crowning the summit of a succession of terraces; it has a fine colonnade, but is a low building, by no means hand-

some, and only deserving of notice from the interesting associations connected with it. In the same neighbourhood is the New Palace, a vast brick building containing 200 apartments, and exhibiting much gaudy magnificence, erected by Frederick at the end of the Seven Years' war in a spirit of bravado, to show that his revenues were not exhausted. There are other two palaces in the environs of the town, one called the Marble Palace (a summer residence of the Emperor William II.), the other the Babelsberg. Potsdam was an unimportant place till the great elector selected it as a place of residence and built the royal palace in the town (1660-73). Improvements have been made in it by nearly all the kings of Prussia. The most distinguished native of Potsdam is the celebrated Alexander Von Humboldt. Pop. in 1885, 50,877; in 1895, 58,452; in 1900, 59,814.

POTSDAM, a town in the United States, in the state of New York, county of St. Lawrence, 11 miles E.N.E. of Canton and 16 miles from the river St. Lawrence. The township has several saw-mills employed in preparing lumber for the New York and Boston markets, foundries, machine-shops, manufacturing of furniture and agricultural implements, &c. Pop. of town (1890), 3981.

POTSTONE (*Lapis ollaris*), a species of talc containing an admixture of chlorite. Its colour is green of various shades; it is greasy and soft, but becomes hard on being exposed to the air. It derives the name of potstone from its capability of being made into vases, &c., by turning—a purpose to which it is often applied. It was well known to the ancients, who obtained it from quarries in the Island of Siphnos (now Siphanto), one of the Cyclades, and in Upper Egypt. It is now quarried in the Valais in Switzerland, in Norway, Sweden, Greenland, and the neighbourhood of Hudson's Bay.

POTTER, JOHN, primate of all England, born in 1674, was the son of a linen draper of Wakefield, in Yorkshire, in the grammar-school of which town he received the rudiments of a classical education. He then became a member of University College, Oxford, and in 1694 fellow of Lincoln College. In 1697 he printed an edition of Lycophrone. Soon after (1697-99) appeared his *Archæologia Græca*, or the Antiquities of Greece, in two vols. 8vo, which has gone through many editions, and was long indispensable to the classical student. In 1706 he became chaplain to Queen Anne, on which occasion he graduated as Doctor in Divinity. In 1708 he was appointed regius professor of divinity at Oxford, in 1715 was raised to the see of Oxford, and in 1737 was appointed Archbishop of Canterbury. He died in 1747. His works, besides those enumerated, are *A Discourse on Church Government* (1707), an edition of *Clemens Alexandrinus* (1714), and theological works, printed together, in three vols. 8vo (Oxford, 1753).

POTTER, PAUL, a painter of animals, born at Enkhuizen in Holland in 1625, was the son of Peter Potter, a painter, from whom he received his first instruction, but to whom he himself was greatly superior. As early as his fifteenth year he had executed a work which was universally admired; and after he settled at the Hague he was unable to satisfy the demand for his works. His department was the painting of animals and landscapes, but he was more particularly successful in the former; the latter were designed merely to afford an opportunity for exhibiting animals in different attitudes and circumstances. His colouring is uncommonly brilliant, and the separate parts are most delicately executed, yet without any appearance of stiffness or mannerism. His pieces were generally of a small size; but there is one in the museum of the Hague, which originally belonged to the Prince of Orange, representing a man and cattle, with a

bull in the foreground as large as life. It is well known as *Paul Potter's Bull*. His walks were always occupied in study; whatever struck his fancy he immediately sketched. He died in 1664, at the age of twenty-nine years, at Amsterdam, where he had been residing two years. His engravings are not less esteemed than his paintings. His cabinet pieces command a very high price.

POTTER'S CLAY. See CLAY.

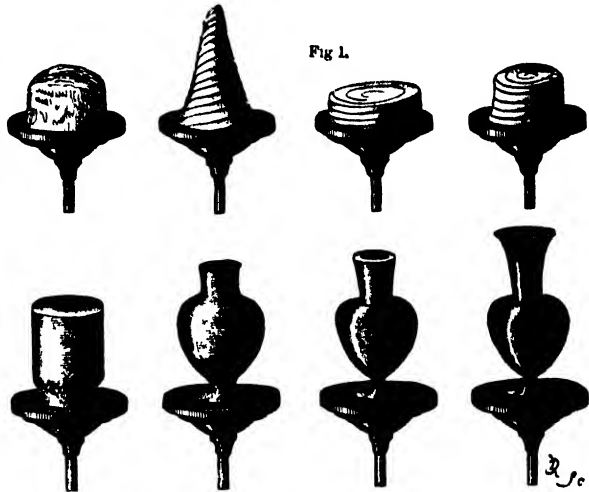
POTTERY. The art of forming vessels or utensils of any sort of clay, kneaded with water and hardened in the fire, is of high antiquity, and we find mention of earthenware in the Mosaic writings. The Greeks at an early period had potteries at Samos, Athens, and Corinth. Demaratus, father of Tarquinius Priscus, is said to have instructed the Etruscans and Romans in this art, of which the Etruscan vases show the great perfection. (See ETRURIA and VASE.) Glazed earthenware was long supposed to be of no older date than the ninth century of our era, and to have first originated with the Arabs in Spain; but the discovery of glazed bricks in the ruins of Babylon, of enamelled tiles and glazed coffins in other ancient cities, proved that this is not the case. The Arabs, however, are entitled to the credit of having introduced the manufacture into modern Europe. The Italians seem first to have become acquainted with this kind of ware, as it was manufactured in the Island of Majorca, and hence they gave it the name of *majolica*. The art of making it was learned by them in the fifteenth century, when they set up their first manufactory at Faenza. In Italy the art was improved, and a new kind of glaze was invented, probably by Luca della Robbia. As the Italians had become acquainted with the glazed ware in Majorca, and hence given it the name of *majolica*, so the French derived their first knowledge of it from the Italian manufactory at Faenza, and on that account gave it the name of *faience*. About the middle of the sixteenth century the manufactory of Bernard Palissy at Saintes in France became famous on account of the beautiful glaze and rich ornaments by which its products were distinguished. A little later the Dutch began to manufacture at Delft the more solid but less beautiful ware that takes its name from that town. The principal improver of the potter's art in Britain was Josiah Wedgwood in the eighteenth century. A variety of stoneware takes its name from him. Porcelain or chinaware first became known in Europe about the end of the sixteenth century through the Dutch, who brought it from the East. For further particulars regarding the history of pottery see FAIENCE and CHINAWARE.

Though the various kinds of pottery and porcelain differ from each other in the details of their manufacture, yet there are certain general principles and processes which are common to them all. The first operations are connected with the preparation of the potter's paste, which consists of two different ingredients, an earthy substance, which is the clay proper; and a silicious substance, which is necessary to increase the firmness of the ware, and render it less liable to shrink and crack on exposure to heat. Each of these ingredients is first prepared separately, after which the two are incorporated together and undergo some further processes before the compound material is ready for the potter. The earthy substance or clay is first thrown into a cylindrical or conical vessel, in which revolves an upright shaft armed with a number of knives so arranged that the flat sides of their blades are in the line of a spiral curve. There are also fixed knives on the sides of the cylinder, arranged in the same way as those on the revolving shaft, but with their edges turned in the opposite

direction, that is, upwards. The result of the action of this machine is to bring the clay to an extreme degree of comminution, while at the same time the spiral movement of the knives, operating like a screw, forces the clay downwards till it makes its escape by an aperture at the bottom of the cylinder. It is then conveyed to a vat, where it is mixed with water and well stirred till it is reduced to a uniform pap. The agitator consists of a revolving vertical shaft, from which proceed at right angles two or four vertical series of spokes, the extremities of which are joined by vertical bars. When the mixture has been churned by this machine, called a *blunger*, till it has acquired something like the consistence of cream, it is run off through a set of wire, gauze, and silk sieves into cisterns, where it is diluted with water to a standard density. The other ingredient of the potter's material is usually ground flints, or flint-powder, as it is called. The processes by which the flint nodules are reduced to powder are the following:—They are first washed, then heated red-hot, and thrown into water to make them brittle and destroy their translucency. They are next pounded in a stamping-mill until they are reduced to a coarse powder, which is brought to the requisite degree of fineness by grinding in a mill between masses of chert. This fine powder is subsequently treated much in the same way as the clay, so that at the end of the separate treatment there are two liquors in separate sets of cisterns. These liquors are now mixed in such measure that the dry flint-powder bears to the clay the proportion of one-sixth or one-fifth, or even more, according to the quality of the clay and the practice of the manufacturer. The mixture is then run into long shallow troughs called *slip-kilns*, underneath which is an arrangement of flues intended to promote evaporation. There remains after evaporation a uniform inelastic mass, which is cut into cubical lumps, and transferred in this form to a damp cellar, where the lumps are piled one above another, and allowed to remain for several months. During this time a process of fermentation or disintegration goes on, by which the paste becomes finer in grain and not so apt to crack in the baking. But even after this process the ingredients composing the paste are not thought to be intimately enough incorporated together nor sufficiently fine in texture until another operation has been undergone. This is called *slapping* or *wedging*, and is performed in this way:—A workman takes each lump in succession in both hands, and by a sudden twist breaks it across; then strikes the two halves together in a different direction, and dashes the mass down on a board. This he repeats more than a score of times, after which the paste is ready to be shaped into the vessels which it is intended to make. This final process of incorporation and comminution is sometimes performed not in the way described, but by a machine similar to that by which the clay is first operated on—that containing the arrangement of fixed and revolving knives. When this machine is used the clay is passed through it several times before the operation is regarded as complete. The same object is sometimes effected in yet other ways both in this country and abroad.

In making earthenware vessels, if they are of a circular form, the first operation after the paste has been

made is turning, or what is technically called *throwing* them on the wheel. This is an apparatus resembling an ordinary turning-lathe, except that the surface of the chuck is horizontal instead of vertical. The chuck is in fact a revolving table, in the centre of



which a piece of clay is placed, which the potter begins to shape with his hands. The rotary motion of the table gives the clay a circular form, and it is gradually wrought up to the intended shape. Fig. 1 shows the different stages of an earthenware vessel wrought on the wheel. It is then detached from the revolving table and dried, after which it is taken to a lathe and polished with a tool. It is at this stage of the manufacture that the handles and other appendages are fitted on, which is done by means of a thin paste called *slip*. The articles are now removed to a room, in which they are laid on shelves and dried more thoroughly at a temperature of 80° to 90° Fahr. When they have reached a stage which is called the *green* state they are again taken to a turning-lathe, on which they are more truly shaped, as well as smoothed and burnished. When the articles are not of a circular form, and accordingly cannot be thrown or turned, they are either pressed or cast in moulds. In the former case the paste used is of the same consistence as that used on the wheel, and the moulds into which they are pressed are made of Paris plaster. In the latter case moulds of the same sort are used, but they are always kept thoroughly dry, so as to have great absorbent power, and the clay mixture is poured into them in the condition of slip. By the absorption of the water in the parts next the mould a crust is gradually formed of the shape of the mould, and of greater or less thickness, according to the time that the liquid is allowed to remain. The moulds are then reversed, and the excess of liquid is allowed to run out. Pieces are always cast in this way in halves, which are afterwards carefully joined together. It is evident that this method is only suitable for hollow articles.

When shaped and dried the articles in the hands of the potter are ready for the kiln, in which they are heated until they acquire a sufficient degree of hardness for use. The paste of which the earthenware is composed is thus converted into what is called *bisque* or *biscuit*. While undergoing this process of baking the articles are inclosed in larger vessels, called *saggars* or *seggars*, to protect them from the fire and smoke, and to distribute the heat more uni-

formly. The saggars are made of baked fire-clay, and are glazed internally. They have no lid, but are piled up in the kiln above one another, so that the bottom of one serves as a lid for the one below. The crevices between the different saggars are carefully closed with soft clay, and the top sagger in each pile or *bung* is covered with an unbaked one, attached in the same way. When a kiln is filled it may contain from forty-eight to fifty bungs, each made up of eighteen or nineteen saggars. Fig. 2 is a section of a potter's kiln of two stories. F F are the labora-

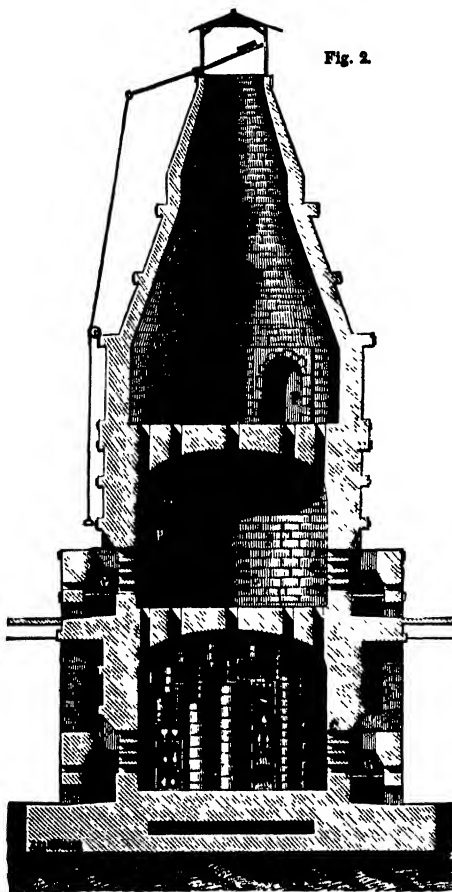


Fig. 2.

ories, in the lowermost of which are seen the piles or bungs of saggars, some of which are shown in section to discover the arrangement of the vessels inside; c c are the furnaces, o o the flues, and p p doors. In order to indicate the progress of the baking a number of cups called *watches* are introduced into the kiln in an unbaked sagger, and are taken out by the attendant at fixed intervals as the baking goes on. According to the appearance of the watches the attendant increases or moderates the heat, and when the last watch is of the proper colour he gradually allows the fire to be lowered, and finally to go out. The whole firing lasts from forty to forty-two hours, during the first part of which period the kilns are heated to a comparatively moderate temperature, but during the latter part the heat is made much greater. After the kilns have been allowed to cool very slowly, the articles are taken out, and if they are not to be printed, that is to receive

a coloured design, sometimes also when they are to be printed, are immersed in some glazing mixture called *glaze cream*, a vitrifiable composition, which, after the vessels have been a second time subjected to heat, is converted into a coating of glass, which renders the vessels impermeable to water. Three kinds of glaze are used in Staffordshire—one for common pipe-clay or cream-coloured ware, another for the finer pipe-clay ware, and a third for the ware which is to be ornamented by painting with the pencil. Various compositions are used in making these. In the glaze-kiln the vessels are arranged in the same way as in the biscuit kiln; only the saggars containing vessels covered with one kind of glaze are put in different parts of the kiln from those covered with another kind of glaze, since different kinds of glaze require different temperatures. The watches used in baking the glaze, to indicate the progress made, are pyrometric balls, coated with a very fusible lead enamel, and at the various stages these are compared in colour with the balls reserved from the corresponding stages of the previous baking. The firing lasts about fourteen hours, after which the temperature is reduced very slowly, slight additions of fuel being made to prevent a too rapid loss of heat.

The preceding processes are all that are necessary to complete a plain earthenware vessel, but very frequently the vessels are adorned with printed designs or paintings. Two methods are adopted in printing on earthenware—press-printing, which is done on the bisque; and bat-printing, done on the glaze. For the first method engravings are first executed on copper, in which the lines are cut pretty deep. The colouring matter, mixed with boiled oil, is then applied to the plate, which is meanwhile kept hot. The surface of the engraving is then rubbed clean, so as to leave the colouring matter only in the lines of the engraving, and in order that the colour may not spread and confuse the lines of the design, the oil, which serves as a vehicle for it, must be pretty thick and firm. When this is done a sheet of thin paper called pottery tissue, which is previously saturated in a solution of soap and water, is laid on the surface of the engraving, and this on being taken off carries with it the coloured design. When the superfluous parts of this sheet of paper have been cut off it is transferred to the bisque, and well rubbed, to make the impression sink into the ware. The article is then immersed in water, and the paper wiped off with a sponge. Lastly, the impression is freed from oil in the hardening kilns, and the vessel is glazed. For bat-printing an engraving is first made, as for press-printing, on copper, but in this case the lines are not made so deep. The lines of the engraving are filled with pure linseed-oil, which is taken off by sheets of a flexible preparation of glue, by means of which it is applied to the glazed surface of the ware. Finely-ground colour is then dusted on, and the vessel is ready to be fired in the enamel kiln.

All the numerous varieties of earthenware are made in the manner just described, with only slight modifications in the nature of the ingredients of their composition or the processes of manufacture. In warm countries a species of earthenware vessels are made which remain porous, and when filled with water promote evaporation through the body of the ware, and thus keep the water cool. In Spain these are called *alcazaras*, probably from the town of Alcarazza, where they are largely made, and this name is the one by which they are known in this country. Their biscuit is said to contain a good deal of granular sea-salt, to the expulsion of which in the baking the porosity of the ware is largely due. Stoneware may be formed of the clays which are used for other vessels, with the addition of different sorts of sand, and

sometimes of cement. A greater degree of heat is applied than in the case of ordinary earthenware, and this has the effect of increasing the strength and solidity of the material, and when some fluxing substance is added, of producing that state of semi-fusion which is the distinguishing quality of stoneware. The glaze formerly used was invariably common salt. When the furnace had arrived at its greatest heat a quantity of this substance was thrown in, and the salt arising in vapour enveloped the hot ware, and by the combination of its alkali with the silicious particles on the surface of the ware, produced a perfect vitrification. Instead of this a mixture of Cornish stone, flint, and other ingredients has recently come into use. A kind of semi-vitrified ware, first made by Wedgwood, takes its name from him. It is made of two different kinds of pastes, both very plastic, so as to admit of all kinds of raised ornaments being wrought in them, and afterwards attached to the articles. This ware is incapable of taking on a superficial glaze; but by a process called *smearing*, which is simply baking at a high heat in saggars coated internally with a salt glaze, acquires a remarkable lustre. Naturally it is of a cream colour, but may have any other colour imparted to it by means of metallic oxides and ochres.

Porcelain or chinaware, which is the most beautiful and expensive of all earthenwares, is formed only from argillaceous minerals of extreme delicacy, united with silicious earths capable of communicating to them a certain degree of translucency by means of their vitrification. Porcelain is of two kinds, hard and tender. Both consist, like other earthenwares, of two parts—a paste which forms the biscuit, and a glaze. The biscuit of hard porcelain is composed of kaolin or china clay, a substance which in Great Britain is found in greatest abundance in Cornwall, and of decomposed felspar, to which is added at the manufactory of Sèvres a small proportion of Bougival chalk. The glaze consists of a felspar rock reduced to a very fine powder, and mixed with water, so as to form a milky liquid, into which the articles are dipped after undergoing a preliminary baking which is enough to make them perfectly dry and sufficiently solid to bear handling. Tender porcelain biscuit is mainly composed of a vitreous frit, that is, a composition made up of several ingredients differing at different manufactories, but always including a large proportion of silicious sand or ground flints, all baked in a furnace together till they are half-fused, and then reduced to the condition of powder. The glaze of tender porcelain is a specially prepared species of glass ground fine, and made into a liquid by mixing with water. To this frit is added a certain quantity of white marl or bone-ash. The processes employed in manufacturing porcelain wares of both kinds are very much the same as those used for other kinds of earthenware, but they all require much more delicacy and care. The biscuit paste even of hard porcelain has so little tenacity compared with that of the ordinary varieties of earthenware, that it cannot without difficulty be shaped on the wheel, and moulds are consequently more frequently used. Besides this the translucency of the ware when baked reveals the slightest flaw in the biscuit, so that even if the paste were equally tenacious with that of ordinary earthenware, much more skill would be required in the workmanship. Hence it happens that while a good workman at the Sèvres porcelain manufactory will make no more than from fifteen to twenty plates in a day, a workman in an English pottery, with the assistance of two boys, will make in the same time from 1000 to 1200. The paste of tender porcelain again is still less tenacious, so that the wheel cannot be used for it at all, and a little mucilage of gum

or black soap must be added to it before it can be worked even in moulds. During the baking, too, it becomes so soft that every part of an article made of it must be supported. Each article in porcelain must be placed in the kiln in a separate sagger, and the saggars must be prepared with more care than those of ordinary earthenware, and of special materials. Tender porcelain receives two coats of the glaze, which is fused in the upper part of the kiln at the same time that the biscuit is baked in the lower.

Metallic oxides incorporated with some fusible flux, such as borax, flint, &c., are used for painting on porcelain. For gilding the gold is mixed with quicksilver and a flux, which give it the appearance of a black dust. The colours are mixed with essential oils and turpentine, and applied by means of a camel's-hair brush. Before being applied a ground-colour is dusted on the surface of the piece to be painted, which is previously covered with a uniform coat of boiled oil. If any parts are to be kept free of the ground-colour, they are protected by what is called a *stencil* (usually a mixture of rose-pink, sugar, and water). After the colour has been dusted on the vessel is heated, that the oil and colour may be hardened, and is then immersed in water, that the stencil may be washed off. It is then ready for the hands of the painter. When the painting is finished the vessels are baked in a peculiar kind of ovens called *muffles*, which are also used for fixing the printed figures on the glaze of stoneware. These ovens are of an oblong shape, and have semicircular roofs with openings in them to allow of the escape of the vaporous matters of the colours and the essential oils with which they are mixed. The articles are accordingly not inclosed in saggars, but when the muffles are charged, their mouths are covered with fire-tiles, the chinks round which are carefully closed with clay. By the operation of the furnace most of the colours employed in painting porcelain become quite different, and the change which takes place in them is usually through a series of tints, so that the proper tint will not be obtained unless the baking is stopped precisely at the proper time. The parts that have been brushed with the gilding mixture have the colour of gold after the baking, but must be burnished before they acquire the requisite lustre. While the colours on porcelain are being fixed in the muffles the articles, especially the larger ones, are apt to crack by a too sudden increase or lowering of the heat. This risk, added to that of running the colours by an error in the amount of the baking to be undergone, makes the execution of a painting in porcelain a very difficult matter; yet many of the paintings with which such articles are adorned are genuine works of art. In the International Exhibition at London in 1871 some specimens of porcelain were exhibited with designs etched on them by means of fluoric acid. The etching is done before glazing, and the lines may previously be filled in with gold or some colour in enamel. Sculptures are sometimes executed by casting in moulds in various kinds of porcelain, called statuary porcelain, *Parian*, *Carrara*, &c.

The name of hot-cast porcelain is given in America to a milk-white translucent kind of glass made by melting cryolite, siliceous sand, or pure sand and oxide of zinc together, and pouring the mixture into moulds.

The chief seat of the manufacture of all kinds of earthenware in Great Britain is Staffordshire, a district in the north-west of which, having an area of 16 square miles, goes by the name of 'The Potteries.' In 1900 the total value of earthen and china ware exported from the United Kingdom was £2,038,009.

POTTO (*Haplorhina*), a genus of Lemuroidea or Lower Monkeys, inhabiting Madagascar. This form is

of a light-brown colour, and averages about 14 inches in length. The tail is comparatively short. The native name for the Potto is 'Ampongna.' (See *LEMUR, QUADRUANA*.) Potto is also a name for the *Cercoptes* or kinkajou (which see).

POTTSVILLE, a town in the United States, in Schuylkill county, Pennsylvania, 93 miles north-west of Philadelphia in the centre of the great anthracite coal-field, at the termination of the Schuylkill Canal, and of the Philadelphia and Reading and the Schuylkill Valley Railways. It occupies a very picturesque site immediately above the gorge where the Schuylkill breaks through Sharp Mountain, and though of modern origin, having sprung into existence in consequence of the discovery of its valuable minerals, is now a well-built, stirring place. The manufacturing establishments include blast furnaces, forges, foundries, rolling mills, steam-engine and machine factories. A very large trade in coal is here carried on. The Pottsville Collieries have two vertical shafts 1640 feet deep—among the deepest in America. Pop. (1890), 14,117.

POTWALLERS, or **POTWALLOPERS** (pot-bollers), persons who, in certain English boroughs, such as Old Sarum, before the Reform Act of 1832, qualified as voters in parliamentary elections by cooking their own food in the open air within the bounds of the borough for which they voted.

POUCHET, **FÉLIX ABOHIMÈDE**, a French scientific writer and investigator, born at Rouen in 1800. He graduated in medicine at Paris, and in 1828 he was appointed professor at the museum of natural history in Rouen. In 1838 he became professor in the medical school of Rouen. Among his writings are *De l'Ovulation Spontanée et de la Fécondation des Mammifères et de l'Espèce humaine*; *Histoire des Sciences naturelles au Moyen Age*; *Hétérogénéité*; *L'Univers, ou les infiniment Grands et les infiniment Petits*. He died at Rouen on Dec. 6, 1872.

POUDRETTE, the name given to a powdery manure obtained from ordure. The matter is put into the first of a series of large shallow tanks on different levels, the first being the highest. After being allowed to remain in this first tank long enough for the more solid and heavy parts to sink to the bottom, the more liquid portions are run off into the second, where after a certain period of repose another deposit is formed. This is continued until the matter reaches the last tank, from which the liquid, now almost completely deprived of solid particles, is permitted to run off into a channel, by which it is conveyed to some brook or river. The solid deposits that remain are then withdrawn and transferred to prepared ground, where they remain till they become perfectly dry, which does not happen till after the lapse of some years. At the end of this time the substance is in a proper condition for use. It is pulverulent, of a brown colour, and almost inodorous. It contains on an average about 25 per cent. of water, and 25 per cent. of fixed salts. It is largely made in France, and is in demand in all quarters, being found particularly useful for gardens. Its efficacy, weight for weight, is five times that of cow dung. In preparing the powder there is a very considerable waste of material, and different expedients have been devised for securing the efficacy without incurring the waste. One of these is the conversion of the material into what is called animal black (*noir animalisé*). In this case the matter on its arrival at the place of manufacture is mixed with an equal quantity of carbonized earth, which allows a greater quantity of liquid constituents to be retained. In the process of drying further quantities of ordure are added, till the earthy portion is only one-fourth of the whole. By this process two or three months suffice for drying.

POUGHKEEPSIE, a city in the state of New York, United States, situated on the east bank of the Hudson River, 75 miles north of New York city. It is built on a plateau about 200 feet above the river, and the slope leading thereto is laid out with some regularity, has many shade trees, and is very attractive. The river Hudson is here crossed by a splendid cantilever railway bridge, constructed in 1886-89. It is known as the 'City of Schools', and is noted for its institutions of learning. Vassar College, the first established and largest college for women in the world, as located here, also Eastman Business College, two military schools, and several seminaries for both sexes. The principal manufactures are of mowing machines, shoes, glass, pottery, iron, and dye-stuffs. Poughkeepsie is connected by railroad with New York, Albany, and the eastern states. It was settled by the Dutch at the close of the seventeenth century; the first substantial building was erected about 1705. The place was temporarily occupied as the capital of the state shortly after the organization of the government, and was the seat of the Convention of 1788, at which the federal constitution was adopted. Pop. in 1890, 22,206.

POULPE. See *OCTOPUS*.

POULTICES. See *CATAPLASMS*.

POULTRY, a general name for all birds bred for the table, or kept for their eggs. The birds most commonly included under this designation are the fowl in the restricted sense of the term (see *COCK* and *FOWL*), the pea-fowl, the guinea-fowl, the turkey, goose, and duck. It is unnecessary here to go into details concerning these birds, as separate articles will be found on each of them. There is one remark, however, which we may now make as bearing on the qualifications of the most important occupant of the poultry-yard, the domestic fowl, that there is one great difference between the varieties of this bird, namely, that some are disposed by constitution to continue laying throughout the whole season without sitting; while others after having laid from twelve to fifteen eggs sit obstinately, and seem to take their chief pleasure in this function, and the consequent ones of nursing and rearing. The former varieties are obviously the best where there is a large demand for eggs; and the latter, where the principal demand is for fowls for the table. Of the nine varieties of the domestic fowl which are most commonly kept in England, six may be classed as fowls which sit, and three as fowls which do not sit, except rarely. The former are the Malay fowl, the Cochin China fowl, the Dorking and its sub-varieties, the Game fowl and its sub-varieties, the Lark-crested fowl, and the Bantam; and the latter, the Spanish fowl, and the Hamburg and Polish fowls, with their sub-varieties.

The accommodation given to the poultry stock in the farm-steading is usually indifferent in character, and limited in extent. But if poultry are to be kept at all, they should be kept so as to turn them to the best account. They should have a lofty spacious house, with a yard and shed attached. The house should be moderately warm, well lighted, and perfectly dry. Where the requisite degree of warmth cannot be otherwise obtained, it might be advantageous to heat the house by a system of flues or by heated air. There are in common practice two ways of fitting up the interior of the poultry-house. The one is to form boxes along the walls to serve as nests for the fowls; the other to have shelves along the walls merely, on which baskets to form the nests may be put. These boxes and the shelves may be formed of wood; but for the farm-steading they are better when constructed of smoothly polished flagstones or slates. The usual arrangement is to have for the larger fowls a row of boxes 2 feet high, 3 feet deep,

and 2 feet wide next to the floor, but raised above it by a step 6 inches in height; and on the top of these large boxes to have one, two, or three tiers of smaller boxes, generally 15 inches in width, height, and depth. The top of the lowest boxes, projecting 9 inches beyond the tier above, forms a gangway in front of the second row of nests; and gangways are formed for the others, either by making the horizontal divisions wider, or by adding a board carried by brackets. To prevent the straw from being drawn out of these box-nests, a batten 3 inches high and 2 inches thick, rounded on the upper edge, is laid along the front to form a step. It is not fixed permanently, as it has to be removed to admit of the nests being washed out. When shelves merely are adopted they are placed from 18 inches to 2 feet apart. It is a decided improvement on this plan to place the nests not close to the wall, but at such a distance from it as to leave a passage between them and the wall. The side of the nests next the passage is then formed of lattice-work or wire-netting, made to open like a door. This arrangement, besides tending to keep the nests sweet, and admitting of their being more easily cleansed, allows the fowls to be set and the eggs to be withdrawn without going into the house.

The floor of the poultry-house should be formed of smooth flags or slates, with perfectly close joints. It should either sink towards the centre, in which case there should be an eye there communicating with the drain; or rise from all sides to the centre, in which case there should be a smoothly cut water channel round the walls, but about a foot from them. This last form admits of readier cleansing. The front of the step leading to the first row of boxes should be of the same smooth flag which forms the floor, and should not be vertical, but inclined. The skirting round the walls where there are no nests should be a continuation of this stone fronting, and inclined also. The walls should be smoothly plastered flush with the skirting. The best form of the roof is the hopper shape, with a ventilator at the apex. Proper roosts must be provided, either by building in rounded battens between wall and wall, or by erecting vertical posts or pillars in the centre of the apartment, and fixing to them frames for the roosts.

The house should be well lighted by one or more sliding windows, or by roof-lights. If roof-lights are adopted it is necessary to provide the means of admitting air near the floor of the apartment. Besides the door for the attendant, it is usual to make a small opening for the fowls, closed by a sliding shutter. This opening is generally made at the height of about 3 feet above the floor, and is reached by inclined gangways or ladders outside and inside. The yard for the poultry has only this peculiarity, that it is surrounded by a low wall, surmounted by a paling or lattice fence of wood or iron-wire.

If it can be avoided turkeys and geese had better not occupy at night the same house with hens and ducks, as they are apt to be cross and mischievous, especially at sitting birds. A low range of small fowl-houses, each just large enough to admit a parent bird and her brood, to be shut up separately at night, will be found extremely useful during the breeding season, and will prevent many deaths and so-called accidents among the young. A very small pond is sufficient for the thrifty rearing of both geese and ducks. It should be very carefully constructed with smooth closely-jointed stones, and should be provided with a supply pipe, an overflow, and a waste pipe, the last to admit of its being emptied and cleansed. It may be remarked in general that the grand requisite for success in the rearing of poultry is watchful attention, untiring industry, and a cheerful

determination to make the most of the means at hand.

Fowls are subject to annoyances from many insects. They are often covered with lice, swarming with fleas and bugs, and the spider-fly (*Ornithomyia avicularia*) glides amongst the feathers. Cleanliness in their dwellings is the best security against such visitors. The gapes are occasioned by a worm called *Fasciola trachealis*, which, if not attended to, always proves fatal to chickens. It is, however, not difficult to remedy on its first appearance, either by administering Epsom salts mixed with the food, or in doses of two scruples; or if the barley and oats on which they are fed be mixed with urine instead of water, feeding them thus three or four times a day will be found equally efficacious. Another successful remedy is to take a pinion feather and strip it, excepting 1½ inch at the extremity, thrust it gently down the bird's throat, turning it round and drawing it out, until all the worms are extracted. Some gamekeepers are very expert in the operation, thus relieving pheasants and partridges hatched under hens from the gape-worm.

POUNCE (a corruption of *pumice*), gum sandarach or some other substance pounded and sifted very fine, to rub on paper in order to prevent ink from spreading on it. The best pounce for this purpose is ground cuttle-fish bone. Pounce is also the term applied to charcoal dust inclosed in a piece of muslin, or some other open stuff, to be passed over holes pricked in a work, in order to mark the lines or designs on paper, silk, &c., placed underneath, which are to be afterwards finished with a pen and ink, a needle, or the like; or to any other colouring matter prepared and used in a similar manner.

POUND, in English law, an inclosed place for keeping cattle which have strayed on another man's ground, until they are replevied or redeemed. A pound may be either overt or covert. A pound overt is one built by the lord of the manor for the use of himself and his tenants. A pound overt is thus a common pound, but a common pound may also belong to a parish or village, as well as a lordship. A pound covert is a close place for the exclusive use of the person on whose ground it lies. When cattle are put into an overt or common pound their owner is bound to feed them, and no notice need be given him of his having to do this; but when they are put into any other open place than a common pound the owner is not bound to feed them, unless he receive notice to do so. When they are put into a private or covert pound it falls to the person impounding them to feed them, but he is entitled to charge the owner of the cattle the cost of keeping them in settling with him for the amount of damages to be paid. An attempt to release from a pound cattle lawfully impounded is punishable, according to 6 and 7 Vict. cap. xxx., by a fine not exceeding £5, with costs. In Scotland, the seizing of stray cattle, and keeping them until damages are paid is called pointing of cattle. See POINDING.

POUND, an English weight of two different denominations, *avoirdupois* and *troy*. The pound *avoirdupois* contains 7000 grains, and is divided into 16 ounces; and the pound *troy* contains 5760 grains, and is divided into 12 ounces. In the old apothecaries' weight the pound *troy* was used, but in the revised weights and measures of the British pharmacopoeia the pound *avoirdupois* is adopted. For the use of the pound *avoirdupois* in natural philosophy, see POUND AVOIRDUPOIS.—*Pound* is also the highest monetary denomination used in British accounts, being equal to 20 shillings. The name has originated from the fact that the pound in silver coins was equal to one pound weight of standard silver.

POUNDAGE, a sum paid for every pound sterling. Thus, there was formerly a subsidy of 12 pence in the pound paid under this name to the king on the value of all exports and imports. A poundage of 1s. is allowed a sheriff for a writ of *fiat facias* for all sums levied not exceeding £100, and 6d. for every sum of one pound over and above that amount. A penalty of £40 may be imposed if more is exacted. A poundage was formerly allowed also for writs of *capias ad satisfaciendum*, but it was abolished by 5 and 6 Vict. cap. xcvi. s. 3.

POUND AVOIRDUPOIS, the unit of mass commonly employed in England. It is the mass or quantity of matter (as indicated by the inertia of matter) of a certain piece of metal kept in the exchequer chambers. The use of the pound as a unit of mass, in natural philosophy, is gradually dying out in favour of the gramme (the mass of a cubic centimetre of water). The weight of a pound of matter of any kind at London, in vacuo, is commonly employed by engineers as a unit of force, and is called 'the gravitation unit of force', to distinguish it from the 'absolute unit' or poundal.

POUQUEVILLE, FRANÇOIS CHARLES HUGUES LAURENT, well known by his work on Greece, was born in 1770 at Merlerault, in the department of Orne, studied medicine, accompanied the expedition to Egypt and Syria, and after a tour to Constantinople and Greece was sent by Napoleon as general to Ali Pasha at Janina, and in 1812 appointed consul-general at Patras. He was a member of the Academy of Inscriptions and the Medicinal Academy, and died at Paris in 1838. As early as 1801 he made himself known by a Dissertation on the Plague, as observed by him in Egypt and Syria (*De Febre Adeno-Nervosa*); then appeared his *Voyage en Morée, à Constantinople et en Albanie*, &c. (three vols. Paris, 1806), with maps; next his *Voyage en Grèce, avec Cartes, Vues, et Figures* (six vols. Paris, 1820-22; also printed in the *Univers Pittoresque*); and, lastly, *La Grèce, Histoire et Description* (Paris, 1835). Another work, which was published ten years before the last, and even gained more popularity than any of the preceding, was his *Histoire de la Régénération de la Grèce, 1740-1824* (four vols. Paris, 1824). It contains many gaps, and is far too favourable to the Greeks, but still presents valuable materials which may yet be turned to good account.

POURSUIVANT, or PURSUIVANT, in heraldry, the lowest order of officers at arms. The poursuivants are, properly, attendants on the heralds, when they marshal public ceremonies. There are now four poursuivants, the Rouge Croix, the Blue Mantle, the Rouge Dragon, and the Portcullis. The first two are of old but uncertain date, and the last two were instituted by Henry VII., the Rouge Dragon on the day before his coronation, and the Portcullis at a subsequent period. The Rouge Dragon was named from the ensign of his ancestor Cadwaladr, and the Portcullis from one of his own badges.

POUSSIN, GASPARD, a very eminent landscape-painter, the son of a Frenchman, but born in Rome in 1613. His real name was Dughet; but he is commonly known either by the name given at the head of this article, or by that of Le Guaspre. His sister was the wife of Nicolas Poussin. The disposition which he early showed for painting caused him to be placed under his brother-in-law, whose surname he assumed; and being a lover of the country and its sports he devoted himself to rural sketches, and became one of the greatest masters of landscape upon record. He practised his art with great distinction in various parts of Italy, but chiefly in Rome, where he lived a life of celibacy, and freely expended his gains in hospitable attentions to his

friends, as well as on the pleasures of the table and the chase. He worked with extreme celerity, although nothing can exceed the beauty of his scenery, and the precision of his perspective. He particularly excelled in the representation of land-storms, in which every tree seems agitated, and every leaf in motion. In his figures he was less happy, and they were frequently supplied by Nicolas. Gaspar Poussin died, according to D'Argenville, in 1675, and to others in 1663; but the former date is preferred. He engraved eight of his own landscapes.

POUSSIN, NICOLAS, historical and landscape painter, was descended from a noble but poor family, and born at Andelys in Normandy in 1593 or 1594. He first studied in his native place, and then at Paris, under masters of little merit; but he made astonishing progress. He had already acquired considerable reputation when, in 1624, he went to Italy for the purpose of improving himself in his art. At Rome Marini the poet, with whom he had become acquainted and contracted a friendship at Paris, inspired him with a taste for the Italian poets, in whom Poussin found rich materials for the subjects of his paintings. After the death of Marini (1625) he was left without patronage, and obliged to sell his productions at very low prices. He continued, nevertheless, indefatigable in the study of geometry, perspective, architecture, anatomy, and other sciences necessary for a painter, and in the practice of his art. His conversation, his walks, his readings were also almost always connected with it. In his figures he copied antiques; he modelled statues and reliefs with great skill, and he might have become an excellent sculptor. In his landscapes he followed nature; they usually represent plains with magnificent ruins. All his works show much study; nothing is introduced without a purpose, or merely as an afterthought. For a considerable time he lived in rather poor circumstances, and was at last reduced to a state of destitution by an illness brought on by his excessive labours. He was now, however, taken care of by a Frenchman, Jacques Dughet (the father of Gaspar Poussin), who received him into his house, and tended him till his recovery. In 1630 Poussin married the daughter of his benefactor. About this time his affairs began to improve. He found liberal patrons in Cardinal Barberini (to whom he had been recommended by Marini, but who had been hitherto unable to show him any favour on account of his absence from Italy), and in the Cavaliere Cassiano del Pozzo, for whom he painted the celebrated Seven Sacraments. These works likewise gained him celebrity in France; and Cardinal Richelieu, at the suggestion of Desnoyers, invited him to Paris to paint the great gallery of the Louvre. Louis XIII. appointed him his first painter, with a pension of 3000 livres. Poussin arrived in Paris in 1640, and executed numerous works, particularly historical pieces from the Old Testament, and a repetition of his Seven Sacraments, but was much harassed by his enemies. The painter Jacques Fouquières had been employed to decorate the gallery with views of the principal cities of France, and the architect Mercier had overloaded it with ornament. Poussin found himself under the necessity of beginning his undertaking with the removal of their labours. He also had to contend with the whole school of Simon Vouet, who was protected by the queen; and his paintings were less justly appreciated by the French, who leaned to the brilliant and showy, than by the more correct taste of the Italians. An artist who loved quiet, and had been all his life devoted to his art, could not be contented in such a situation, and he soon determined to leave Paris. In September, 1643, while employed on cartoons of the Labours of Hercules for the gallery

of the Louvre, he returned to Rome, which he never again quitted. He died there in 1665. Although Louis XIV. allowed him to retain his post and pension, yet he never became rich; his disinterestedness made him neglect the opportunity of acquiring wealth; he laboured more for fame than for money. Full of veneration for the ancients, he aspired to the lofty ideal which he observed in them. His drawing is remarkably correct; his composition judicious, dignified, and noble. His invention was rich; his style grand and heroic. His expression approaches that of Raphael, and he has been called the Raphael of France. His merits were due to his own efforts. His only pupil was his brother-in-law Gaspar, who became distinguished as a landscape-painter. Poussin had studied the works of Titian, but his later productions are inferior in colouring to his earlier, since he paid less attention as he advanced in life to this branch of the art, and more to the design. Poussin has been censured for a too studied arrangement, and a too great propensity to episodes; too much uniformity in the attitudes, air, and expression of his figures; an excessive fulness in the drapery, and too small proportions in his figures—faults which may have been owing to his close imitation of the ancients. But notwithstanding these faults Poussin may be compared with the greatest Italian masters. John Ruskin, it may be noted, expressly excludes N. Poussin from his chief criticisms of pre-Turnerian landscape-painters. Among his most celebrated works are the Seven Sacraments, the Deluge, the Death of Germanicus, the Capture of Jerusalem, the Plague of the Philistines, Rebecca, the Adulteress, the Infant Moses, and Moses bringing Water from the Rock, the Worship of the Golden Calf, John Baptizing in the Wilderness, &c., and many fine landscapes. There are lives by Bouchitté (1858) and Poillon (2nd ed., 1875).

POWELL, BADEN, writer on mathematical and theological questions, was born near London on Aug. 22, 1796. Entering Oriel College, Oxford, in 1814, he graduated B.A. in 1817 with first-class honours in mathematics, and proceeded M.A. three years later. After a short tenure of the curacy of Midhurst he became vicar of Plumstead, Kent, in 1821. He was elected F.R.S. in 1824, and was in 1827 appointed Savilian professor of geometry at Oxford, on which occasion he resigned his living. He died in London on June 11, 1860. Professor Powell contributed many papers on optics, radiant heat, and other physical subjects to the *Philosophical Transactions*, and he wrote a *History of Natural Philosophy for the Cabinet Cyclopaedia*, but he is best known by his essay in the celebrated *Essays and Reviews* (1860) on *The Study of the Evidences of Christianity*. Earlier theological works of a similarly liberal and latitudinarian character are *The Connexion of Natural and Divine Truth* (1838); *Tradition Unveiled* (1839); *The Unity of Worlds* (1855); *The Study of Natural Theology* (1856); *Christianity without Judaism* (1857); and *The Order of Nature* (1859). Professor Powell was twice married, and among his sons are Sir George Baden-Powell, Baden Henry Baden-Powell, writer on Indian land questions, and Lieut.-Col. Robert S. S. Baden-Powell, 'the hero of Mafeking' (see POWELL in SUPP.).

POWER, in law, is an authority which one man gives to another to do certain things which the agent would not be otherwise entitled to do; and it is sometimes a reservation which a person makes in a conveyance for himself to do some acts, as to make leases or the like; thus, a *power of attorney* is an instrument or deed whereby a person is authorized to act for another, either generally or in a specific transaction. A power is given by will or deed.

POWER LOOMS are driven by water or steam, and are now universally introduced into cotton and woollen manufactories. See WEAVING.

POWERS, HIRAM, an American sculptor, the son of a farmer, was born at Woodstock, Vermont, 29th July, 1805. He received an elementary education at a free district school, and on the removal of the family to Ohio in 1819 was employed successively in a hotel reading-room, a produce store, and as assistant to a clock-maker. Forming the acquaintance of a German sculptor he soon learned to produce plaster busts of considerable merit. He was subsequently appointed director of the waxwork department of the Western Museum of Cincinnati, an office which he held for seven years. In 1835 he resolved to depend for support upon his labours as a sculptor, and repaired to Washington, where he was for some time profitably employed in modelling busts of distinguished men. With the proceeds derived from these efforts, and the aid of General Preston, he was enabled to carry out his long-cherished desire to visit Italy. In 1837 he established himself at Florence, where, with the exception of occasional visits to Rome, he resided until his death, which took place 27th June, 1873. His statue of Eve Tempted, which excited the warm admiration of Thorwaldsen, was produced in 1838; in 1843 was modelled the still more popular Greek Slave, of which six copies in marble, and innumerable casts and reduced copies, are in existence. Among his other statues the most notable are—*The Fisher Boy* (1846); another *Eve Tempted* (1850); *America* (1854), destroyed by fire in 1866; *Il Penseroso* (1856); *California* (1858); and *The Indian Girl* (1872); and statues of Washington for the state of Louisiana, of Calhoun for South Carolina, of Webster for Boston, and of Franklin and Jefferson. He also executed several ideal busts, such as *Genevra* (1840); *Proserpine* (1845); *Psyche* (1849); *Diana* (1852); *Christ* (1866); *Faith* (1867); *Hope* (1869); and *Charity* (1871), besides busts of Jackson, Adams, Everett, Van Buren, Longfellow, and other distinguished Americans.

POWERS OF EUROPE, GREAT, a term of modern diplomacy, by which are now meant Britain, France, Austria, Germany, Italy, and Russia.

POYNING'S LAW, or Statute of Drogheda, an act of Parliament passed in 1495, whereby all general statutes before then made in England were declared of force in Ireland. See IRELAND—History.

POZOBLANCO, a town in Spain, in the province and 36 miles north of Cordova. It has regular and paved streets, and there are woollen, earthenware, and other manufactories. Pop. (1887), 11,556.

POZZOLANA, or POZZUOLANA, a substance formed of volcanic ashes. When mixed with a small portion of lime it quickly hardens, even under water, and in consequence it is peculiarly valuable as a cement in the erection of moles and other buildings in maritime situations. It received its name from Pozzuoli.

POZZUOLI, the ancient *Puteoli*, a town of Southern Italy, 6 miles W.S.W. of the city of Naples, on the north-eastern shore of the Bay of Baiae (Golfo di Pozzuoli), the north-western portion of the Bay of Naples. The coast forms a natural harbour, which is well sheltered; and an active fishing is carried on. The town is the see of a bishop, and there are a cathedral, two parish churches, &c.; but Pozzuoli is chiefly interesting for its numerous memorials of classic ages. The cathedral stands on the site of a temple of Augustus, and in one of the lateral walls six Corinthian columns of the old temple are preserved. At the western extremity of the town a narrow street leads to the Serapeum or temple of Serapis, an Egyptian god invoked by the priests to sustain the healing virtues of the mineral waters of

the place. It consisted of a square court, inclosed by forty-eight massive marble and granite columns, and with forty-three small chambers adjoining. The portico rested on six Corinthian columns (three of which still remain). In the centre of the court stood a circular temple, surrounded by a peristyle of sixteen Corinthian pillars. The lower portions of the ruins are under water. The base portion of the central columns have been bored by shell-fish, which fact along with others have led some eminent geologists to maintain that there have been here striking changes in the level of the coast. On the eminence behind the town stands the ruined amphitheatre, resting on three series of arches which were surrounded by an external court. The two principal entrances were adorned with triple colonnades. About 25,000 spectators could have found accommodation. The arena, which was 358 feet long by 147 feet broad, could be laid under water by means of a conduit when naval combats were to be represented. The celebrated gladiator-combats got up by Nero during the stay of Tigranes, king of Armenia, took place here. The other objects of interest are the ruins of the temples of Neptune and of the Nymphs; and the Solfatara, a half-extinct volcano near the town, from the crater of which vapours and sulphureous gases ascend, and on the sides of which small brooks have their source, the saline waters of which are used as a remedy for cutaneous diseases. At a short distance inland, bounded by chestnut and vine-clad hills, lies the celebrated Lake Avernus. See AVERNUS.

Pozzuoli was founded by the Greeks of Cumæ about 520 B.C., and was called by them Dicearchia. It obtained its Latin name Puteoli either from its numerous wells or from the stench arising from the mineral wells in the neighbourhood. It was indebted for its importance to its excellent harbour, which was protected by an extensive mole, to which Caligula attached a floating bridge extending as far as Baïe, a distance of 2 miles. Extensive remains of the mole still exist. Puteoli was the chief emporium for the commerce with Alexandria and the greater part of Spain. Here St. Paul landed on his way to Rome. It was taken and plundered by Alaric in 410 A.D., by Genseric in 455, and by Totila in 545. It was rebuilt by the Byzantine Greeks, but suffered severely from earthquakes and volcanic eruption. Its importance has recently been augmented by the establishment here of Armstrong, Mitchell, & Co.'s works for supplying guns, armour-plates, and machinery to the Italian government. Pop. 16,639.

PRACHATTITZ, a town in Bohemia, in the district of same name, 22 miles W.N.W. of Budweis. It is an ancient place, with narrow, gloomy streets; has a fine church, a town-house of a venerable and majestic appearance, a court-house, superior German school, barracks, and hospital. The staple manufacture is brandy. Pop. (1890), 4141.

PRADES, a town in France, department of Pyrénées-Orientales, right bank of the Tet, in a rich and verdant valley, 24 miles W.W. of Perpignan. It has a large and handsome church, a court of first resort, a communal college, a secondary ecclesiastical school, and an hospital; manufactures of woollen cloth, molasses, leather, and paper; and a trade in corn, fruit, wine, flax, hemp, horses, mules, cattle, fine wool, &c. Pop. 3134.

PRADIER, JAMES, a statuary, born at Geneva in 1792, went to Paris in 1809, and studied design under Meynier, and statuary in the studio of Lemot. In 1813 he gained the prize of the Academy for a bas-relief of Philoctetes and Ulysses. This work procured him admission into the French Academy at Rome. Here he developed his talents by studying the antique, and returned to Paris with two statues,

one of a Bacchante and the other of a son of Niobe. In 1821 he went a second time to Rome, where he remained till 1823, and brought back a beautiful statue of Psyche, which he had made out of part of the shaft of an ancient marble pillar found at Veii. From this period he worked constantly at Paris, and produced a great number of larger and minor sculptures, including a Venus, a most lovely group of the Three Graces, a model of Jean Jacques Rousseau, after which the casting at Geneva has been made, and Cyparissus with his goat and a huntress. He was admitted to the Institute in 1827, and afterwards executed, among other works, a Prometheus, a Faun and Bacchante, a Phidias, the bas-reliefs on the pediment of the chamber of deputies, the allegorical figures of Lille and Strasburg in the Place de la Concorde at Paris, the Industry in front of the exchange, the Flora, which he himself regarded as one of his most successful works, the Twelve Colossal Victories on the monument of Napoleon in the Hotel des Invalides, the Atalanta in the exhibition of 1851, and the Sappho, which was exhibited in 1852. In the same year, while taking a walk near Paris, he was suddenly seized with illness, and expired. The execution of his works ranks him a sculptor of the first class, but his conception is by no means free from defects, and there is, according to the colder critics of England, a decided meretriciousness in his style. He has the merit of having formed several distinguished pupils.

PRADT, DOMINIQUE DUFOUR DE, once Archbishop of Mechlin, and a well-known political writer, born in 1759 at Allanches, in the old province of Auvergne, early adopted the ecclesiastical life, and at the outbreak of the revolution was grand-vicar to the Cardinal de la Rochefoucault, archbishop of Rouen. The clergy of Normandy sent him to the constituent assembly, in which he voted in the interests of the clerical and royalist parties. On the closing of the convention he fled to Hamburg, where, in 1798, he published anonymously the first and most famous of his writings, *Antidote au Congrès de Rastadt*, and soon after *La Prusse et sa Neutralité*, in which he censured the coalition of the European powers for making peace with France, urged a new war against the French Republic, and prophesied its overthrow. After the 18th Brumaire he returned to France and was presented by Duroc to the first consul, who was so pleased with his talents that he made him first almoner. On the emperor's coronation in 1804 he received a present of 50,000 francs, and was made a baron and Bishop of Poitiers, and in 1808 Archbishop of Mechlin and officer of the Legion of Honour, and was presented with a second present of 50,000 francs. In 1812 he was intrusted with an important mission to Warsaw, in which he failed, and was deprived of his office as almoner, and ordered to his diocese. On the approach of the allies to Paris he proceeded thither to take part in the negotiations as to its capitulation. The provisional government made him chancellor of the Legion of Honour. During the Hundred Days he lived on his estate in Auvergne. After Napoleon's banishment to St. Helena he showed himself again in Paris, and published his *Histoire de l'Ambassade dans le Grand Duché de Varsovie*, in which he gave full scope to his hatred of his former protector. About this time the King of the Netherlands purchased his right to the archbishopric for an annuity of 10,000 francs, and his office of grand-chancellor was bestowed by the Bourbons on Marshal Macdonald. Thus deprived of all his offices, and reduced to the simple Abbé de Pradt, after some fruitless attempts to gain influence with the Bourbons he abjured legitimacy, and began to write in defence of constitutional freedom and against the abuses of the clergy.

—a new career, which procured him some degree of popular fame. He was twice prosecuted for the too free expression of his ideas, but on both occasions was acquitted. Among his other writings not already mentioned are his *Parallèles de la Puissance Anglaise et Russe*, *Du Congrès de Vienne*, *Les Quatre Concordats*, *Le Congrès de Carlsbad*, and *Du Jesuitisme Ancien et Moderne*. He died at Paris in 1837.

PRAED, WINTHROP MACKWORTH, a celebrated author and politician, was born in 1802. He was educated at Eton, where in 1820 he became one of the principal contributors to a magazine published there called *The Etonian*. From Eton he went to Trinity College, Cambridge, where in 1823 he obtained the chancellor's prize for an English poem entitled *Australia*, and the following year the same prize for another entitled *Athens*. On the publication of *Knight's Quarterly Magazine* he became one of the chief contributors to it, both in prose and verse, many of his poems displaying a rare degree of excellence. In 1829 Mr. Praed was called to the bar, and in 1830 and 1831 was returned for St. Germans to Parliament, where he took a prominent part in opposing the passing of the reform bill. He sat subsequently as member for Great Yarmouth, and afterwards for Aylesbury. He acted also for a short time as secretary to the board of control, and became ultimately recorder of Barnstable and deputy high-steward for the University of Cambridge. In the midst of a promising career he was prematurely cut off in July, 1839. A collection of his poems, which are mostly of a light and elegant character, was published at New York in 1844; but a far more complete edition is that of London, 1864.

PRÆFECT, the title of various functionaries of ancient Rome. Of these the most important was the *praefectus urbi* or *urbis*, or warden of the city, originally called *custos urbis*. The name *praefectus urbi* does not seem to have been used till after the time of the decemvirs. During the kingly period and the early years of the republic the *custos urbis* exercised within the city all the powers of the chief of the state in his absence; he convoked the senate, held the comitia, and on any emergency might take such measures as he thought proper. When the office of *praetor urbanus* (see PRÆTOR) was instituted the wardenship of the city was swallowed up in it; but the conservative spirit of the Romans still induced them to appoint annually a *praefectus urbi* for the time during which the consuls were absent from the city to celebrate the *Feriae Latinae*. (See FESTIVAL.) This functionary had neither the power of convoking the senate nor the right of speaking in it, and the title became a nominal distinction conferred by the consul on young men of illustrious families. Under Augustus, however, the office ceased to be a sinecure. The *praefectus urbi* was a permanent magistrate whom the emperor invested with all the powers necessary to maintain peace and order in the city. He had under him a sort of police called *militēs stationarii*; and the powers of the office were gradually so far extended that at last there was no appeal from his sentence except to the emperor, whereas the *praefectus urbi* was empowered to hear appeals from the sentence of any other city magistrates, and even from those of the governors of provinces. The *praefectus praetorio* was the officer who commanded the troops who guarded the emperor's person. (See PRÆTORIANS.) The office was first instituted by Augustus, and was at first only military, and had comparatively little influence attached to it; but under Tiberius it became of much greater importance, and the power of these praefects became only second to that of the emperors. From the time of Severus to that of Diocletian they had the superintendence of all the departments of

the state—the palace, the army, the finances, and the law; they also had a court in which they decided cases. The office was not always confined to military officers, and was filled on several occasions by distinguished jurists. In addition to these functionaries there were the *praefectus aquarum*, who was charged with the regulation of the water supply of the city; the *praefectus aerarii*, who had charge of the public treasury; the *praefectus vigilum*, who commanded the night-watch; with some others of less importance.

PRÆMUNIRE, in English law, a name given to a kind of offence of the nature of a contempt against the king (or queen) and the government, and is so called from the opening words of the writ preparatory to the prosecution of the offence—*præmonere* or *præmunire facias A. B.* (Cause A. B. to be forewarned that he appear before us, &c.) The first statute of praemunire was during the reign of Edward I. to repress the Papal encroachments on the rights of the crown, and several subsequent statutes before the Reformation greatly extended the number of penal acts under this title, and by still later statutes acts of a very miscellaneous nature have been rendered liable to the penalties of praemunire, as knowingly and wilfully solemnizing, assisting, or being present at any marriage forbidden by the Royal Marriage Act; asserting by preaching, teaching, or advisedly speaking that any person other than according to the acts of settlement and union has any right to the throne, or that the sovereign and Parliament cannot make laws to limit the descent of the crown; to assert that both or either of the Houses of Parliament have or has a legislative authority without the sovereign; and so on. The punishment is forfeiture and imprisonment during the sovereign's pleasure. Many of the statutes are now repealed, and prosecutions upon praemunire are unheard of in our times; the last took place during the reign of Charles II.

PRÆNESTINE. See PÆLESTRINA.

PRÆTOR, an important official in the ancient Roman state. Up to 367 B.C. the title was merely an adjunct to that of consul, but when at that date the consulship was thrown open to the plebeians, the judicial functions of the consul were separated from his other duties and given to a new patrician magistratus, called the praetor. The praetor was a kind of third consul; he was called the colleague of the consuls, and was appointed in the comitia centuriata with the same auspices. In the absence of the consuls from Rome he exercised their functions in the city, the senate, and the comitia. He was a curule magistrate, and had the imperium, although subject to the consuls, and was attended by six lictors. Originally the praetor was a consul of the preceding year, and after the admission of plebeians to the office it was filled for some time alternately by the patrician and plebeian consul of the former year. In 246 B.C. another magistracy, that of *praetor peregrinus*, was instituted for the purpose of settling disputes between foreigners and between foreigners and citizens; and in distinction from him who filled this office the other functionary was termed *praetor urbanus*. After election the two praetors determined their offices by lot. The praetor urbanus was the first in position, and was specially spoken of as the praetor; he was the chief magistrate for the administration of justice, and could not remain more than ten days from Rome. To the edicts of the successive praetors the Roman law is said to owe in a great measure its development and improvement. So long as the power of Rome was confined to Italy there were only two praetors, but on the subjugation of Sicily and Sardinia, and their formation into provinces in 227, praetors were appointed for their government; and the same thing took place on the

conquest of Spain. Under Sulla the number of prætors was raised to eight; under Julius Cæsar the number rose gradually to sixteen. The number varied from about twelve to sixteen during the empire. Under the emperors their power was considerably reduced, but the office continued to exist to a late period.

PRÆTORIANS. In the times of the republic the *cohors prætoria* was a body of troops selected to guard the person of the commander (in old Latin, *prætor*) while in active service. But Augustus established a standing body-guard, consisting of three cohorts, called *prætorians*. This number was afterwards increased to nine, and a body of horse was finally added. In order to avoid the appearance of despotism Augustus stationed only three of these cohorts in the city and dispersed the remainder in adjacent towns. Tiberius, however, under pretence of introducing a stricter discipline among them, assembled them all in Rome, where a strongly fortified camp (*castra prætoria*, or *prætoriana*, or *prætorium*) was assigned them. Their number was increased by Vitellius to sixteen cohorts of 1000 men each. Their term of service was originally fixed at twelve years, but was afterwards extended to sixteen. They received double pay; the privates were considered equal in rank to the centurions of the regular army, and when they had served their time each received 20,000 sesterces (over £150). Under the later emperors, particularly from the time of Commodus, they often deposed and murdered the emperors, and raised their favourites, or even (as in the case of Didius Julianus) the highest bidder, to the throne of the Cæsars. Their commander (*præfectus prætorio*) became the most important officer in the state. (See **PREFECT**.) The prætorian guards were abolished by Constantine the Great in 312, their camp destroyed, and those who had not perished in the battle between that emperor and Maxentius were drafted into the regular legions.

PRAGMATIC SANCTION, a public and solemn decree relating to church affairs pronounced by the head of the legislature, distinguished from the simple rescript, which was a declaration of law in answer to a question propounded on behalf of an individual. In European history several important treaties are called pragmatic sanctions. 1. The ordinance of Charles VII. of France, drawn up at Bourges in 1438 conformably to the decrees of the Council of Basel, and on which rest the liberties of the Gallican Church. 2. The decree of the German Diet at Mainz in 1439, which sanctioned the same decrees as this council. Both limited the Papal power, but were altered by subsequent concordats. 3. The instrument by which the German emperor, Charles VI., being without male issue, endeavoured to secure the succession to his female descendants. It was in accordance with this instrument that he settled his dominions on his daughter Maria Theresa. He induced most of the European sovereigns to guarantee it; but Charles Albert, elector of Bavaria, the next heir to his dominions, refused; this caused the Austrian war of Succession after the death of the emperor in 1740. In the Peace of Füssen (1745) Bavaria acknowledged the pragmatic sanction. 4. Charles III. of Spain, when he ceded the throne of Naples to his third son and his successors in 1759, called the law of succession which he prepared for this branch of his family *sancio pragmatica*.

PRAGUE (Bohemian, *Praha*; German, *Prag*; Latin, *Praga* or *Marobudum*), the capital of Bohemia, near the centre of the kingdom, on both sides of the Moldau, here crossed by eight bridges; 153 miles north-west of Vienna, with which and with Dresden it is connected by railway. Its site is a

regular basin, cut in two by the river, from the banks of which the houses rise in succession, tier upon tier, till they are terminated and inclosed by hills of considerable height. When viewed from the old bridge no city in the empire surpasses Prague in grandeur of appearance. The bridge (repaired in 1892 after being damaged by a flood) was erected between 1357 and 1507, has 16 arches, and is defended by a strong tower at each end; the buttresses are adorned with groups of statuary. The town was formerly inclosed by fortifications, but these have mostly been removed, and their sites occupied by private buildings, pleasure grounds, roads, &c. Among the chief quarters of the town are now the Altstadt, Josephstadt, and Neustadt on the right, and the Kleinseite and Hradschin on the left bank. Outside the line of the old walls lie the suburbs Karolinenthal, Smichow, Wyschehrad, Bubna, and others. The Altstadt and Josephstadt lie along the right bank towards the north. The streets of the Altstadt are narrow, but this being the principal seat of trade and business, and the special quarter occupied by the Jews, contains some of the best shops, besides numerous churches, ecclesiastical and educational establishments. The Neustadt incloses the Altstadt on the north-east, east, and south-east. Though newer than the other, it is still very ancient, having been built by the Emperor Charles IV. in 1348. It is not the scene of so much activity as the Altstadt, but its streets are wider. On the opposite side the Kleinseite forms the aristocratic quarter, the chosen abode of the Bohemian nobles, and the site of several remarkable palaces. The Hradschin, to the west and south of the Kleinseite, occupies the side of a steep hill, is of less extent, and contains far fewer houses than any of the other quarters, but perhaps surpasses them all in interest, in consequence of the public edifices which it contains. The principal public edifices are the old castle, or palace of the Bohemian kings, situated in the Hradschin; the cathedral, also in the Hradschin, a Gothic structure somewhat shapeless from having never been completed, and much dilapidated by the injuries which it sustained from the balls of Frederick the Great during the Seven Years' war; the Clementinum, the seat of the theological and philosophical faculties of the university and the Carolinum, devoted to the faculties of law and medicine; the Theinkirche, a Gothic church, historically interesting as the place where the Bohemian estates made George Podiebrad their king, and to some still more interesting as containing the grave of the celebrated astronomer Tycho Brahe, who spent his last years at Prague; the palace of Wallenstein, originally a structure of great magnificence, but now much dilapidated; the Alte Rathaus (old townhall), an irregular Gothic edifice of the fifteenth century, with a dungeon beneath in which the Emperor Wenzel IV. was confined for fifteen weeks; the chief synagogue of the Jews, probably as ancient in date as the end of the twelfth century; the military hospital, which is a large and magnificent edifice, originally erected by the Jesuits as a college; the theatre, the opera-house, the national museum, museum of natural history, picture gallery, the technical high schools, Landesbank (1896), municipal savings-bank (1894), central market hall (1896), the new Ritterakademie (1896), &c. The manufactures consist of gold and silver embroidery, silk, woollen, cotton, and linen goods, buttons, hats, leather, paper, soap, refined sugar, vinegar, liqueurs, refined salt, gloves, sugar of lead, stearine and tallow candles, machines, musical and mathematical instruments, firearms, porcelain, jewellery, &c. The trade is of great importance; Prague, owing to its central position, its situation on the

Moldau, which secures it a free communication with the Elbe, and to its facilities of transport by roads and railway, being the great entrepôt for all the traffic of the kingdom. It has also several important fairs, particularly one for wool, which lasts seven days, and during which a great amount of business is done; that of St. Wenceslaus, the old patron saint of Bohemia; and that of St. John Nepomuk, though these two are rather religious festivals than fairs, and are more crowded with devotees than dealers.

Prague is one of the oldest towns in the kingdom, and is supposed to have been founded in 722 by the Duchess Libussa, but its history does not become important till the middle of the fourteenth century. In 1348 Charles IV. founded the university, the first which Germany possessed, and it soon acquired such celebrity through the teachings of such zealous rectors as Huss and Jerome that it was resorted to from all quarters of Europe, and is said to have had at one time over 20,000 students. In consequence, however, of quarrels between the Bohemian and foreign students, and the decision of the emperor in favour of the former, several thousand foreign teachers and students left the university, which led to the foundation of the Leipzig, Ingolstadt, Rostock, and Cracow Universities. Since 1883 there have been two universities, one Czech and one German, and to the original three faculties of the former a fourth (theology) was added in 1892. The total number of students attending both is about 3700. In 1424 Prague was taken by the Hussites and almost destroyed, but after their submission to the emperor in 1433 the town was rebuilt. It suffered severely in the Thirty Years' war, and in 1620 a battle was fought at the White Mountain in the neighbourhood, in which the Elector-palatine Frederick V. was defeated by the Emperor Ferdinand II., and compelled to renounce his crown. In 1631 the city was captured by the Saxons, who were driven out a few months later by Wallenstein. In 1742 it was taken by the French and Bavarians, and two years later capitulated to Frederick the Great. After the Seven Years' war the city made rapid strides, and enjoyed peace and prosperity until 1848, when the Austrian government caused it to be bombarded for two days, owing to the marked democratic demonstrations excited by the meetings of the Slavonic Congress within its walls. During the Austro-Prussian war in 1866 the city was occupied by the Prussians, and here the treaty of peace was signed on the 23rd August. Pop. (1890), 182,530, with suburbs, 310,483, mostly Czechs; of town proper in 1900, 201,589.

PRAIRIAL. See **CALENDAR**.

PRAIRIE (French, 'meadow'), the name given to the vast natural meadows or plains of the Mississippi valley, occupying the western part of Ohio, nearly the whole of the states of Indiana, Illinois, and Iowa, the southern part of Michigan, the northern part of Missouri, and portions of Kansas and Nebraska, in which, near the meridians of 97° and 100° w., they gradually pass into arid and desert plains. Throughout this immense territory the differences of level are sufficient to produce a steady flow of the rivers, but not so rapid as to obstruct their navigation, thus securing a system of easy intercommunication between all sections of the country, unsurpassed in importance by any similar system in the world. There is a great sameness in the features of the topography, the vegetable productions, the soil, and geological features. The surface is drained by streams which commence in almost imperceptible depressions of the high prairies, and flow in beds and valleys of gradually increasing depth, between vertical walls of limestone or sandstone

through the horizontal strata of which the current has in past times made its channel. What are called bottom lands lie between the rocky bluffs and the stream, and attain in some places a width of 6 to 8 miles; but they are often wanting entirely, the bluffs on each side coming close up to the river banks. On the Upper Mississippi the bottom lands are generally well wooded, but along the state of Missouri they spread out into wide open plains. On the head-waters of the Illinois and the Wabash, and south and west of Lake Michigan the prairies are very level and smooth, and are termed flat. Elsewhere the surface is undulating and broken by the depressions of the streams, and are known as rolling prairies; some of the highest swells reach an elevation of 1500 feet above the sea level. The depressions where there are no streams are often 50 feet below the mean level, and in the bottom the soil is wet and marshy, forming almost impassable swales or sloughs. In these places the grass grows very rank and tall, but upon the upper and drier surface the natural growth is finer, and the sod dense and closely interwoven. A great variety of flowering plants, mostly various species of the helianthoid Compositæ, are interspersed among the grasses. Trees are sometimes met with in scattered groups called groves, or along the larger streams, or occasionally on low rocky ridges. The soil is remarkable for its finely comminuted condition; it is generally free from stones, though in some localities boulders are met with. In the swales, and in some of the bottom lands, the rich black vegetable mould is very deep, but on the upper prairies its depth is usually from 1 to 2 feet. The subsoil is almost invariably an argillaceous loam, more or less mixed in its lower portions with sand and occasional pebbles. Water is generally found in the sandy stratum 15 to 20 feet below the surface. The underlying rocks are soft, sedimentary strata, especially shales and impure limestones, which disintegrate readily and crumble into soil on exposure. Beneath the prairies, north-west of the Ohio, are extensive coal-fields, with deposits of iron, lead, &c. These vast plains, covering an area of 400,000 square miles, formerly fed vast herds of bisons (buffaloes), deer, wild turkeys, prairie hens, prairie dogs, squirrels, &c.; but these are vastly diminished in numbers now, or have altogether vanished. Remains of ancient mounds, fortifications, and cities show that they were, at some remote period, inhabited by more civilized races than those found by the European discoverers. Immense tracts are now cultivated, and produce large crops of wheat and maize with little outlay of labour on the part of the farmer. The same class of lands in British America are also called prairies, as those between the Rocky Mountains and Manitoba.

PRAIRIE DOG. See **MARMOT**.

PRĀKRIT, certain Hindu dialects, which acquired greater prominence as the older Sanskrit passed gradually out of use. These dialects first assumed a literary position in the Sanskrit dramas, where female characters, both high and low, are introduced as speaking Prākṛit, instead of the Sanskrit used by kings, noblemen, and priests. The modern tongues of India have sprung from the Prākṛit just as the Romance languages have sprung immediately from the old Italian dialects, and not from the literary Latin.

PRAM, **CHRISTEN HENRIKSEN**, an admired poet and miscellaneous writer, was born in 1746, at Lefta, in the Guldbrandsdalen, Norway. He studied at Copenhagen, and gained much by his intercourse with Ewald, Hessel, and others. In 1781, as a member of the agricultural and commercial college of Copenhagen, he undertook several tours, the results of which were published in the *Commercial*

Journal, founded by him in 1782. In 1815 he was discharged from his office with an insignificant pension, and in 1819 accepted the office of collector of customs on the island of St. Thomas, where in 1821 he fell a victim to the climate. His writings, which are numerous and embrace a great variety of subjects, both in political and natural science, display much industry and very extensive acquirements. Among his poetical productions are *Heroide* an *Erich*, which in 1779 gained the prize of the Society of Belles-lettres; *Starkodder*, the most famous Norwegian heroic poem, in fifteen cantos, equally remarkable for its plan, contents, and form; his *Satirical and Comic Tales*, which, with a selection of his poems, were published at Copenhagen in 1824. Besides the Commercial Journal already mentioned, he founded another, called the *Minerva*, which was of essential service in diffusing information in the Scandinavian kingdoms.

PRASE, a dark leek-green variety of quartz, the colour of which is due to an admixture of hornblende.

PRATER, the most famous promenade of Vienna. See VIENNA.

PRATIQUE, a term used to signify a kind of limited quarantine, which the captain of a vessel is held to have performed when he has convinced the authorities of the port that his ship is free from infectious diseases.

PRATO, a town in Tuscany, 11 miles north-west of Florence, in a fertile plain, on the right bank of the Bisenzio. It is surrounded by ancient walls, has suburbs, and is a well-built, cheerful-looking place. It has a court of justice and several public offices; a beautiful cathedral, begun by Nicolo Pisano, and completed after his designs in 1450 with a façade, furnishing a beautiful specimen of Italian Gothic; several other churches, monasteries, nunneries, an old castle, an ancient praetorium (Palazzo Pretorio), now converted into a prison; a college or ecclesiastical seminary, called after its founder Cignolini, and adorned with a fine Italian front; a public library, a theatre, and several hospitals; and extensive manufactures of woollen, cotton, silk, and mixed goods, straw hats, paper, and articles in brass. Pop. Dec. 31, 1881, 13,410.

PRAWN (*Palæmon*), a genus of Crustaceans belonging to the highest order, Decapoda, of that class, and included in the section *Macrura* ('long-tailed') of the order. The outer pair of antennæ possess a large movable plate of oval or triangular shape. In the special family of the Prawns (*Palæmonidae*) the beak or 'rostrum,' which projects in front of the carapace, is large, toothed, and of compressed shape. The feet are of stout conformation, and do not possess basal appendages. The Prawns themselves possess inner antennæ, terminating in three filamentous processes. The first and second pairs of legs are two-fingered or 'chelate,' the second pair being much larger than the first. The beak is specially long and compressed. The Common Prawn (*P. serratus*) is the most familiar species, and resembles the more familiar Shrimps in general appearance. Like the latter forms, prawns are found in great quantities on sandy coasts, whence they are fished by nets, and largely transported to the city fish-markets. When boiled the Prawns become of a pale pink colour, and are highly esteemed as table delicacies in this and in other shapes.

The Common Prawn attains an average length of from 3 to 5 inches. The tail is broad and flat, and its terminal plates are fringed with long hairs. The colour is light-gray spotted with purple. The carapace is more membranous than calcareous, and hence appears almost transparent when the animal is in the

water. The Isle of Wight and Hampshire coasts form the chief sources of prawn supply to the London market. Various other species and varieties of the Prawn genus occur on the British coasts. Of these the *P. Squilla*, *P. Leachii*, and *P. varians* are familiar forms. Several tropical species attain a very large size. See illustration at CRUSTACEA.

PRAXITELES, one of the greatest sculptors of Greece. He was a citizen, if not a native, of Athens, and probably flourished about 364 B.C. He and his contemporary Scopas stand at the head of the later Attic school, so called in contradistinction to the earlier Attic school of Phidias. Without attempting to rival Phidias in his sublime impersonations of divine majesty, Praxiteles chose subjects which demanded a display of the human form, especially in the female figure. Pliny (Hist. Nat. lib. xxxvi. c. 4, 5) gives a list of his principal works. The finest is said to have been the Cnidian Aphrodite (Venus), whom he was the first to represent naked. According to tradition the celebrated courtesan Phryne (see PHRYNE) served as a model for it. Aphrodite was represented with a smiling countenance; the right hand held some drapery, which fell over a vase standing beside her, indicating that she had just left or was about to enter the bath. The statue was purchased by the Cnidians, who valued it so highly that they refused to part with it to King Nicomedes, who offered to pay off their heavy public debt if they complied. It was afterwards carried to Constantinople, where it perished by fire in the time of Justinian. The group of Niobe now in existence, which is also attributed to Scopas, seems to have been the production of different times. His two statues of Eros (Cupid) were also celebrated. One of them, which was placed in the temple of Eros at Thespie, and a statue of a satyr, which was called *peribœtos* (the fur-famed), were considered by Praxiteles, according to Pausanias, as his finest works. An excellent copy of the latter was discovered in a villa of the Emperor Antoninus. Only one unquestionably original work by Praxiteles has yet been discovered, namely, the famous statue of Hermes with Dionysus, which was found at Olympia in 1877.

PRAYER. Nothing proclaims more consistently and universally the connection between man and his Maker than the fact that in every time and place men have felt their dependence on a higher Being, and have sought his assistance in prayer. Even the heathen, who call upon a god that cannot save, show thereby their acknowledgment that they have necessities which they cannot satisfy, and that they believe that there is some One who can supply their needs. The Scriptures tacitly assume that prayer was offered to God from the beginning of the world; there were sacrifices from the time of Abel, and where there were sacrifices there must also have been sacrificial prayers. And although we do not read that men began to call upon the name of the Lord until after Seth was born, we are forbidden by all commentators to connect this statement with the origin of prayer. It is not, however, until the time of Abraham that prayer comes first distinctly into notice. His devout faith prompted him to build an altar wherever he remained, and to call upon God. He was doubtless a priest within his own family and household, and they participated in his services and obtained the benefit of his intercessions. As the altar appears to have been considered the special place for prayer in the patriarchal age, so was the tabernacle under the Mosaic covenant until the temple was built, which was called the house of prayer. From the time of the dedication of Solomon's temple the Jews appear to have gone there to pray, and to have turned their faces towards it if

they were prevented from going there; and this custom prevails among the Jews at the present time, as does the similar custom among the Mohammedans, who turn their faces towards the sacred Kaaba at Mecca. On examining the character of the prayers mentioned in the Old Testament we find that, with the exception of many of the Psalms, they were principally petitions for temporal objects. This is suited to the purposes for which the historical books of the Jewish Scripture were written, as the Mosaic covenant pledged God to confer temporal benefits on his people when they called upon him. We find also that a great number of them are intercessory; thus we have Abraham interceding for Lot, Moses for the people, Samuel for the people and for Saul, David for his nation, Elisha for the dead child, and so on. When we come to New Testament times we meet for the first time with synagogues established as places for the public worship of God, and for reading his word. The leaders in religion—the priests, scribes, and Pharisees—were no longer the faithful servants of God they once were. Christ went among the people doing good—healing the sick and bestowing forgiveness of sins; and the very fact that he exercised divine power caused the people to worship him and to beseech him in terms suited only to a divine being; his disciples pray him to save them from a storm from which no mortal power could deliver them. Thus the way was prepared for the important announcement made by our Lord towards the close of his ministry, that prayer should be offered to God in his name in order to insure an answer. Henceforward Jesus Christ became to the Christian what the temple was to the Jew: he was the embodiment of God, giving a definite object thereby for the faith of the suppliant to rest upon; he was also the propitiation for the sins of the world, and through his blood all that believe in him have access to the Father. The posture of the body in prayer is left undecided in Scripture; both standing and kneeling are mentioned, and Christ adopted both postures. So also is the question about forms of prayer left unsettled. By giving his disciples a form of prayer Christ implied that there are times when these are useful; but he never meant that the free utterance of the soul's wants should be entirely limited by formal services.

Against the testimony and experience of so many ages of mankind the objections of a small minority may be of little importance, yet they must not pass unnoticed. Such objections are generally resolvable into two propositions—1, that if God has foreordained all events no prayer can alter his will; and 2, that if God is omniscient it is useless to inform him of our wants. In answer to the first objection we may ask, Why has God put in us the strong instinct to pray to him if after all he intends to balk it, and if, with all our faith and earnestness, we cannot change the order of his providence? Besides, we know so little about the way in which God acts that it is absurd for us to prescribe certain limitations to him in his modes of action. It is true that God changes not; it is also true that he hears prayer; each of these statements is inexplicable to us, and we cannot reconcile them. The most reasonable method of expressing the doctrine of prayer is to say that it is not a cause of God's actions, but a condition on which he acts. It is a distinct duty of the creature, looked for and waited for by the Creator before he proceeds to grant the request. He as readily foresees the prayer as the need of the thing prayed for, and the one is, generally speaking, the condition on which the other is granted. Prayer is not at all intended to supersede work, because praying and working are supplementary to each other. The second objection follows in the

same groove. It is certain by God's own revelation of himself that he is omniscient; and it is also certain that he requires men to petition him as well as to offer him a pure service of adoration. How to reconcile these two opposite, or apparently opposite, facts, that a beneficent God knows our wants before we can name them, and is loving enough to satisfy them without being asked to do so, and yet requires us to put those wants before him in prayer, and to ask him to satisfy them, is a question that we cannot answer. They are facts that depend for their explanation on mysteries of God's nature which he has chosen to remain mysteries. But it is quite as certain that he has imposed the law of prayer as that it is that he has revealed himself to be omniscient; and while it would be very illogical to accept the revelation as true and to reject the law as false, it would also be folly to accept both as true and yet to refuse to act on the law because we cannot reconcile it with the revelation.

It has been suggested by some thinkers that the effect of prayer is purely subjective, and that its only result is to produce a stronger feeling of dependence in the suppliant. It is true that prayer does exercise a subjective influence, and this is doubtless a part of the work which it is intended to do, but it is not all. For why should God encourage us to pray for our daily bread if he does not intend to give us an answer to our prayers? Does not he that gives spiritual things give temporal things also? But the strongest objection to the theory may be drawn from the fact that intercessory prayer for the bodily and spiritual welfare of others is most strongly urged by example and precept in the Old and New Testament. It would be the merest mockery to pretend to pray for others if the only effect was to be in ourselves. It is dishonouring God to suppose him capable of conniving at this mockery by the exhortations of his holy word. It may be also added that the admission of such a subjective effect is also an admission, to no small extent, that prayer is not a mere fiction but a great reality; for no moral good could be expected to result, or would result, from the constant use of what, if it is not a reality, must be mere fetishism.

Prayer for the dead is a practice rejected by Protestants as having no scriptural warrant, but which prevails in the Roman Catholic, Greek, and other eastern Churches. The custom seems to have existed in most of the ancient religions, especially in those of India, China, and Egypt. The doctrine and practice came to the Christian Church through the Jews (2 Maccabees xii. 43, 45). Those who defend this usage maintain that the efficacy of prayer for the pardon of the sins of the departed is clearly intimated by Christ's teaching in the Gospels. He says that 'whosoever speaketh against the Holy Ghost it shall not be forgiven him, neither in this world nor in the world to come' (Matthew xii. 32), whence by only excluding from forgiveness in the world to come the sin against the Holy Ghost he may be understood to imply that less offences may be forgiven. The first of the Christian fathers who mentions prayer for the dead is Tertullian; but he speaks of the usage as well-known and long-established in the church; such prayers are frequently alluded to by St. John Chrysostom, Cyril of Jerusalem, and St. Augustine. In the burial service of the first Book of Common Prayer of the English Church some prayers for the dead appeared, but they were deleted from the second book, and are not found in the subsequent revisions.

PRE-ADAMITES (from the Latin *præ*, before), those supposed inhabitants of the earth prior to the creation of Adam. The legendary traditions of the

East speak of nations and empires existing before Adam's creation, and of a line of kings who ruled over them. In modern times the subject was taken up by Isaac de la Peyrère, who, in a work published in 1655, maintained that the Jews were the descendants of Adam, and the Gentiles those of a long anterior creation, founding his opinions on Romans v. 12-14. The term pre-Adamitic is sometimes applied to remains of human art discovered in positions which appear to geologists to be of an age beyond the limits which scriptural chronology assigns to the creation of Adam.

PREBEND, a yearly stipend paid from the funds of an ecclesiastical establishment, as of a cathedral or collegiate church. *Prebendary* is the person who has a prebend. A simple prebend has no more than the revenue which is assigned for its support; but if the prebend has a jurisdiction annexed, the prebendary is styled a *dignitary*. Prebendaries, as such, have no cure of souls; and therefore a prebend and a parochial benefice are not incompatible promotions. —The *prebendal stall* is the seat of the prebendary in the church, into which he is inducted by the dean and chapter.

PRECEDENCE, the order in which men and women follow each other in a state procession or on other public occasions. In England the order of precedence depends partly on the statutes 31 Henry VIII. cap. x., and 1 Will. and Mary, cap. i.; on the letters patent 9, 10, and 14 Jac. I.; and partly on ancient usage and established custom. Questions arising on matters of precedence depending on usage are hardly considered as definitely settled, and are in a great measure left to the discretion of the officers of arms. The following are the degrees of precedence as recognized by English law:—

Table of Precedence among Men.

The Sovereign.
The Prince of Wales.
Sons of the Sovereign.
Grandsons of the Sovereign.
Brothers of the Sovereign.
Uncles of the Sovereign.
The Sovereign's brothers' or sisters' sons.
The Archbishop of Canterbury, Primate of all England.
The Lord High Chancellor, or Lord Keeper, being a baron.
The Archbishop of York, Primate of England (the Archbishop of Armagh, before the passing of the Irish Church Act of 1869).
The Archbishop of Dublin, before same act.)
The Lord High Treasurer.
The Lord President of the Privy Council.
The Lord Privy Seal.
The Lord Great Chamberlain.
The Lord High Constable.
The Earl Marshal.
The Lord High Admiral.
The Lord Steward of Her Majesty's Household.
The Lord Chamberlain of Her Majesty's Household.
Dukes.
Eldest sons of dukes of the royal blood.
Marquises.
Dukes' eldest sons.
Earls.
Younger sons of dukes of royal blood.
Marquises' eldest sons.
Dukes' younger sons.
Viscounts.
Earls' eldest sons.
Marquises' younger sons.
Bishops of London, Durham, and Winchester.
All other English bishops according to seniority of consecration.
(The Bishop of Meath, followed by the other Irish bishops according to seniority of consecration—before disestablishment of the Irish Church.)
Secretaries of State, being barons.
Barons.
The Speaker of the House of Commons.
Commissioners of the Great Seal.
Treasurer of the King's Household.
Comptroller of the King's Household.

Master of the Horse.
Vice-chamberlain of the King's Household.
Secretaries of State below the rank of baron.
Viscounts' eldest sons.
Earls' youngest sons.
Barons' eldest sons.
Knights of the Garter.
Privy Counsellors.
The Chancellor of the Order of the Garter.
The Chancellor of the Exchequer.
The Chancellor of the Duchy of Lancaster.
The Lord Chief Justice of the King's Bench.
The Master of the Rolls.
The Lord Chief Justice of Common Pleas.
The Lord Chief Baron of the Exchequer.
Lords Justices of the Court of Appeal in Chancery.
Vice-Chancellors.
Judges and Barons of the Coif (the Judge of the Court of Probate has rank and precedence with them according to the date of his appointment. When sitting in the full Court of Divorce and Matrimonial Causes he ranks after the Chief Baron).
Knights Bannerets, Royal (made by the Sovereign in person in open war).
Viscounts' younger sons.
Barons' younger sons.
Baronets.
Knights Bannerets (not made by the Sovereign in person).
Knights Grand Crosses of the Bath.
Knights Grand Crosses of the Star of India.
Knights of St. Patrick.
Knights Grand Crosses of St. Michael and St. George.
Knights Commanders of the Bath.
Knights Commanders of the Star of India.
Knights Commanders of St. Michael and St. George.
Knights Bachelors.
Companions of the Bath.
Companions of the Star of India.
Cavaliers and Companions of St. Michael and St. George.
Eldest sons of the younger sons of peers.
Baronets' eldest sons.
Eldest sons of Knights of the Garter.
Bannerets' eldest sons.
Eldest sons of Knights of the Bath and of St. Michael and St. George.
Eldest sons of Knights Bachelors.
Baronets' younger sons.
Younger sons of Knights of the Garter.
Younger sons of bannerets.
Younger sons of Knights of the Bath.
Younger sons of Knights Bachelors.
Esquires.
Gentlemen entitled to bear arms.
Clergymen, Barristers at Law, and officers of the army and navy.
Citizens.
Burgesses, &c.

Table of Precedence among Women.

[Married women and widows are entitled to the same rank among each other as their husbands would respectively have borne among themselves unless such rank is merely professional or official; and unmarried women to the same rank as their eldest brothers would bear during the lives of their fathers.]

The Queen.
The Princess of Wales.
Princesses, daughters of the Sovereign.
Princesses and duchesses, wives of the Sovereign's sons.
Grand-daughters of the Sovereign.
Wives of the Sovereign's grandsons.
Sisters of the Sovereign.
Wives of the Sovereign's brothers.
Aunts of the Sovereign.
Wives of the Sovereign's uncles.
Duchesses.
Wives of the eldest sons of dukes of royal blood.
Daughters of dukes of royal blood.
Marchionesses.
Wives of the eldest sons of dukes.
Daughters of dukes.
Countesses.
Wives of the younger sons of dukes of royal blood.
Wives of the eldest sons of marquises.
Daughters of marquises.
Wives of the younger sons of dukes.
Viscountesses.
Wives of the eldest sons of earls.
Daughters of earls.
Wives of the younger sons of marquises.
Baronesses.
Wives of the eldest sons of viscounts.
Daughters of viscounts.
Wives of the younger sons of earls.

Wives of the eldest sons of barons.
 Daughters of barons.
 Maids of Honour.
 Wives of Knights of the Garter.
 Wives of bannerets.
 Wives of the younger sons of viscounts.
 Wives of the younger sons of barons.
 Wives of baronets.
 Wives of Knights Grand Crosses of the Order of the Bath.
 Wives of Knights Grand Crosses of St. Michael and St. George.
 Wives of Knights Commanders of the Order of the Bath.
 Wives of Knights Commanders of St. Michael and St. George.
 Wives of Knights Bachelors.
 Wives of Companions of the Bath.
 Wives of Cavalieri and Companions of St. Michael and St. George.
 Wives of the eldest sons of the younger sons of peers.
 Daughters of the younger sons of peers.
 Wives of the eldest sons of baronets.
 Daughters of baronets.
 Wives of the eldest sons of Knights of the Garter.
 Daughters of Knights of the Garter.
 Wives of the eldest sons of bannerets.
 Daughters of bannerets.
 Wives of the eldest sons of Knights of the Bath.
 Daughters of Knights of the Bath.
 Wives of the eldest sons of Knights Bachelors.
 Daughters of Knights Bachelors.
 Wives of the younger sons of baronets.
 Wives of esquires and gentlemen.
 Wives of citizens, burgesses, &c.

By the acts of Union of Scotland and Ireland the precedence in any given degree of the peerage has been established as follows:—1. Peers of England; 2. Peers of Scotland; 3. Peers of Great Britain; 4. Peers of Ireland; 5. Peers of the United Kingdom and Peers of Ireland created subsequent to the Union.

PRECEDENT, in law, a judicial decision which serves as a rule for future determinations in similar or analogous cases. Precedents, strictly speaking, are binding on tribunals only when they are in the form of actual decisions of the point in question; what is termed an extrajudicial opinion—the opinion of a judge pronounced where it was not called for to decide the issue—can have authority only from the character of the judge, and not as a precedent. While the principles of equity remained unsettled it was considered by many that precedents were inapplicable in that branch of law, as its very name seemed to imply that each case should be governed by the judge's opinion of its individual merits. This supposition has now, however, been refuted, and precedents are of as much authority in courts of equity as in those of common law. Forms of proceeding to be followed in similar cases are also termed precedents.

PRECENTOR (Latin, *præ*, before, and *cantor*, singer), in ancient religious foundations, the official in a chapter, whether cathedral or collegiate, who led the singing of the choir or congregation. It was his province to begin the verse, whilst the people joined with him at the close, a method which was often varied in the same service with antiphonic or alternate psalmody. He ranked generally, although not universally, next to the dean; but in modern cathedral foundations he is usually a minor canon, and in consequence has lost much of his precedence. He is still, however, everywhere the conductor of the choral service, and superintendent of the choir. In the Presbyterian Church it was formerly the habit of the precentor to repair to church half an hour before the minister came, and read to the people several passages of Scripture. When the minister entered the precentor gave out a psalm, and led the singing. After the beginning of the 18th century he ceased by degrees either to read the Scripture or to prescribe the psalm. But his desk, which is generally placed beneath the pulpit, is still called the lectern (Scotch, *lettran*), that is, reading-desk. The practice of the precentor reading each line of the psalm previous to

singing it is still kept up in some of the rural districts of Scotland.

PRECEPTORY, in medieval history, a religious house of the Knights Templars, subordinate to the temple or principal house of the order in London. It was under the government of one of the more eminent knights, whom the grand-master created and styled *Preceptor Templi*. It usually stood on a manor or estate belonging to the order, on which was also a church and other necessary buildings. Of these preceptories sixteen are said to have belonged to the Templars in England.

PRECESSION OF THE EQUINOXES, a slow motion of the equinoctial line, or line of intersection of the equator and ecliptic, which causes the positions occupied by the sun at the equinox (the equinoctial points) to move backward or westward at the mean rate of 50'25" per year. This sweeping round in the heavens of the equinoctial line indicates a motion of the axis of rotation of the earth, such that it describes circles round the poles of the ecliptic in 25,791 years. Nutation (*nutatio*, a nodding) is a similar, but much smaller motion of the axis, whose period is about nineteen years. The axis, therefore, follows a sinuous path, instead of a circle, about the pole of the ecliptic. Nutation causes the equinoctial points to be alternately in advance and behind their mean place due to precession by 6'37". At present the vernal equinoctial point is in the zodiacal sign Pisces, and it is moving towards the sign Aquarius.

Lord Kelvin has devised a useful mechanical illustration of precession. An ordinary 24-inch model of the earth, the southern parts of which are cut away, is supported on a pivot at the centre. At the north pole there is a small shaft which is not fixed in bearings, but merely rests against the inner side of a ring about 9 inches in diameter. The diameter of the ring subtends an angle of 47' at the centre of the globe. To cause the shaft to lean against the ring the globe is made top-heavy. The ring is fixed. When the globe is rotated the shaft rolls round the ring, and its motion is opposite to the rotation of the globe. If the shaft were made so small that it moved round $\frac{1}{257,911}$ part of the circumference during about 365 rotations of the globe, this illustration of the earth's precessional rotation would be perfect. To represent nutation as well, it would be necessary to have about 1350 sinuosities in the ring. The ecliptic is represented by a plane through the centre of the globe parallel to the ring. When an ordinary top spins, it may be noticed that although one point of the axis of rotation is on the ground, and may be immovable, all other points in the axis have a circular motion. It is also to be noticed that the rotation of the axis itself is in the same direction as the rotation of the top about the axis. The top's motion is said to be one of 'positive precessional rotation.' Now, if the point of support of a rotating body be *above* its centre of gravity, it is found that the precession is 'negative,' or the rotation of the axis itself is opposite to the rotation of the top about its axis. In fact, the axis of a body supported in such a way that before rotation it is in unstable equilibrium is capable of taking a positive, and the axis of a stable body is capable of taking a negative precessional rotation. Now precession of the axis of the top is due to the action of a couple such as would tend, if the body had no rotation, to move it from its position of equilibrium; a couple produced by the weight of the top when its axis is not quite vertical. The effect of a couple on a rotating body is well known in dynamics, and may be studied experimentally with a gyroscope. The couple is numerically equal to the moment of momentum which it tends to produce in the body in a

unit of time. When a couple acts upon a body already in rotation its effect may be calculated in the following way. Let a line be drawn from a point in the body, representing the previous rotation, in such a way that it is parallel to the axis of rotation, and its length is numerically equal to the body's moment of momentum; but let this length be measured in a direction regarded as positive (an eye at the extremity of the line ought to see the body rotating in a direction against the hands of a watch). Let another line be drawn from the same point in the same manner, parallel to the axis of the couple, and let its length be numerically equal to the couple. Complete the parallelogram of which these are the sides, and the diagonal will represent the new circumstances of the body's rotation at the end of a second. Now the earth rotates about an axis which is inclined to the ecliptic, so that, except at the equinoxes, one-half of its equator is always above and the other half below the ecliptic. The sun attracts the earth, not as a whole, it is to be remembered, but as consisting of an infinite number of particles; and because of its being nearer, a quantity of matter on the earth is more attracted towards the sun during the day than at night. Hence, as the earth has an equatorial protuberance, and as one-half of this protuberance is more attracted towards the sun than the other; and as these halves are on opposite sides of the ecliptic, the attraction of the sun on the earth is not to be represented merely by a force acting in a line through the earth's centre, but by such a force and a couple. The couple tends to turn the earth, so that its equator may be in the plane of the ecliptic, and although its amount varies periodically, being greatest at the solstices and zero at the equinoxes, the direction in which it tends to turn the earth is always the same. We find that the precession due to this couple is negative; viewed from beyond the north pole the earth turns on its axis against the hands of a watch, but the axis is itself moving very slowly with the hands of a watch. The moon exerts an attractive force on the earth through the centre of gravity, and also a couple tending to turn the equatorial parts of the earth into the plane of the moon's orbit. The moon's orbit makes an angle of only about 5° with the ecliptic, and therefore the general tendency of the couples of the sun and moon is the same. The moon's couple is zero twice during the month (when the moon is at the nodes of her orbit), and it reaches a maximum value twice in the month. The 'retrogression of the moon's nodes' (which see), which is due to the motion of the moon about the earth being a precessional rotation, is a change in the position of the nodes, the whole period or time of describing the orbit being about nineteen years. Thus there is a periodic variation in the moon's couple, whose period is about nineteen years. We see then that, leaving out of account the actions of planets, the phenomenon called precession of the equinoxes is made up of 1. A conical motion of the earth's axis in space, whose period is 25,791 years. 2. A variation in the velocity of this motion, whose period is half a year. 3. A nodding of the axis nearly to and from the pole of the ecliptic, whose period is half a month. 4. A much graver nodding, whose period is about nineteen years.

Green's Theorem (the 'potential' theorem) shows how to calculate the couples due to the attractions of the sun and moon, from pendulum observations at a small number of places on the earth. The probable error in this calculation is certainly not greater than 0.005. The angular velocity of the earth is known, and the amount of precession has been carefully observed. From these data the moment of inertia of the earth about its polar axis has been cal-

culated. We know the mean density of the earth (from 5 to 6 times that of water) from Cavendish's and other experiments; but there are an infinite number of ways in which the matter of the earth might be arranged with regard to density to give the calculated moment of inertia. It is, however, found that if from any of the laws of variation of density which have been suggested, and which lay claim to any probability (Laplace's is the most probable), we calculate the moment of inertia, regarding the earth as a perfectly rigid body, we get a result which is within 5 per cent. of the actual moment of inertia calculated from precession, while the result from Laplace's law agrees with this amount within 0.2 per cent. But if we do not suppose the earth to be rigid we get an enormous discrepancy. In fact the existence of a considerable quantity of fluid inside the earth would cause precession to have a comparatively short period, and any degree of viscosity in the fluid between perfect rigidity and perfect fluidity would cause a rapid subsidence of all the rotatory motions. Lord Kelvin, to whom three independent solutions of the problem of the rigidity of the earth are due, has well illustrated the influence of internal fluid matter on rotation by means of experiments with boiled and unboiled eggs, vessels of water, oil, treacle, and sand similarly suspended by wires, &c.

PRECIOUS STONES. See **GEMS**.

PRECIPITATE. In chemistry this name is applied to a solid body produced by the mutual action of two or more liquids; thus if sulphuric acid be added to an aqueous solution of barium chloride, barium sulphate is produced, and being insoluble in the menstrua present it precipitates, or sinks as a solid to the bottom of the liquid in the vessel. So again, if a solution of potassium iodide be added to a solution of lead chloride, a reaction takes place resulting in the formation of lead iodide and potassium chloride, and inasmuch as the former of these bodies is, under the circumstances, a solid, it is precipitated. As a general rule it may be laid down that if it is possible to produce a solid substance by the action of two liquids on one another, that solid will be produced when these liquids are mixed, and that therefore a precipitate will be formed.

PRECOGNITION, in Scotch law, the 'proof' of a witness, and in criminal proceedings, an examination by a judge or justices of peace, usually conducted under the superintendence of the procurator-fiscal, in order that the facts connected with the offence may be ascertained, and full information given to the public prosecutor to enable him to prepare the libel and carry on the prosecution. In this investigation the witnesses are not usually put upon oath, and they must be examined separately; nor is the accused, or any person on his behalf, allowed to be present while it is going on. The accused cannot cite witnesses in exculpation, nor is he allowed to see a copy of the precognition after it is taken. Those who know anything of the fact may be compelled to come forward; the magistrate officiating at the precognition grants a warrant to summon them, which, if not complied with, will be followed by a warrant of imprisonment. If the accused make a reasonable suggestion as to the propriety of precognosing a particular individual, the judge-examinator may cite and examine the person named as likely to establish the innocence of the accused. The precognition should be reduced into writing, and signed by the witnesses. The duty of conducting precognition now belongs to sheriffs, magistrates of burghs, and justices of the peace.

PREDESTINATION, in theology, the term used to denote the decree of God, whereby the elect are foreordained to salvation. Theologians have generally foreborne to use the word predestination with

respect to the rejected, using instead the word reprobation, as 'it is wicked to say that God has predestinated anything but good' (*nefas est dicere Deum aliquid nisi bonum prædestinare*—St. Augustine). The theory of predestination represents God's absolute will as determining the eternal destiny of man, not according to the foreknown character of those whose fate is so determined, but according to God's own choice. This doctrine has been the occasion of many disputes and controversies in the church in all ages. On the one side, it has been observed that it is impossible to reconcile it with our ideas of the justice and goodness of God, that it makes God the author of sin, destroys moral distinction, and renders all our efforts useless. On the other side, it is contended that if God's knowledge is infinite and unchangeable he must have known everything from eternity; if we allow the attribute of prescience the idea of a decree must be believed also, for how can an action that is to come to pass be foreseen if it is not determined either to do or to suffer it? If God is infinitely wise it cannot be conceived that he would leave things at random, and have no plan. The first great champions of these opposite views were Pelagius and Augustine. The former held the decrees of God as subordinated to the divine knowledge of human character; that there was a possibility of good in man's nature, and that the choice of salvation lay in man's will. Augustine maintained that God's decrees were absolute, and independent of all prior human conditions; that apart from divine grace there is no possibility of good in human nature, and that since the fall man's will has no power of choice. The system of Augustine was adopted in 529 by the Council of Arausio as the rule of orthodoxy in the Western Church. It forms one of the peculiar characteristics of the Calvinistic theology. The question as to God's moving cause in election, whether it is his sovereign will or his foresight of the character of the chosen one, is left undecided by the Anglican Church, and also by the Roman Catholic Church since the Reformation.

PREDICABLES. In those systems of logic which found their theory of definition and division on the scholastic and Aristotelian opinions that theory rests for both processes on the scheme of the predicables. Predicables are terms affirmable, as predicates, of other terms. Further, the identical affirmation of singulars being neglected, all predicables are said to be common terms. All the common terms which are affirmatively predicable of others, must import, with respect to the subject of the proposition, one or other of five things. The predicables are therefore five: genus, species, difference, property, and accident. The first two name the higher and lower classes of the things classified: a genus includes more than one species. The other three express the attributes on which the classification is founded.

PREDICATE, QUANTIFICATION OF THE. See QUANTIFICATION OF THE PREDICATE.

PRE-EXISTENCE, DOCTRINE OF. Some philosophers have maintained that the soul of every individual man has an existence previous to that of his body. This opinion was very prevalent in the East, and something like a belief of it is implied in the question which some of the Jews put to our Saviour respecting the blind man—'Did this man sin, or his parents, that he was born blind?' the obvious inference being, that if it was the man who had sinned, it must have been in some pre-existent state before he became an inhabitant of this world. The same opinion was held by several Greek philosophers, more especially by the Pythagoreans, Empedocles, and also by Plato himself, unless we are to consider the views stated by the last to be an allegory, rather

than a sober statement of belief. A similar doctrine has found some countenance in Christian times among those who were anxious to explain how the soul becomes united to the body, but could not divine any more plausible hypothesis than that all souls were created before the world, and that each has its proper body allotted to it at the time of birth. In favour of this theory appeal is sometimes made to the curious impression we occasionally have that some particular experience is the repetition of a former experience, though reason persuades us that this cannot be. The doctrine or theory has inspired Wordsworth's Ode on the Intimations of Immortality from Recollections of Early Childhood.

PREFET, the title of an important political functionary in France. Previous to the time of Henry II. the officers who were sent round to the provinces to superintend the details of administration on behalf of the sovereign were called *maîtres des requêtes*. That king established them in 1551 as perpetual overseers in all the provinces, and under Louis XIII. in 1635 they received the name of *intendants*. They were bound to unconditional obedience to the ministers, and could be recalled at any time. To their functions belonged the proportional assessment of taxes, the levying of soldiers and their removal, the procuring of supplies for the army and the royal magazines; the keeping of roads, bridges, and public edifices in repair; the care of the common concerns of the districts, the regulation of the trade in corn from one province to another, &c. It was often suggested to introduce, instead of these single functionaries, invested with such arbitrary powers, an administration by public bodies, a part of whose members at least should be chosen by the provinces themselves. But this was never done; and the office of intendants remained till the revolution, and the abuses of their authority contributed not a little to produce this catastrophe. It was therefore one of the first doings of the national convention to abolish these offices, and instead of them to erect in each department a general administration, whose members were chosen by the citizens. A directory of the department was permanent; a council, on the other hand, was to meet every year to fix the expenditures of the department, to audit accounts, and to exercise a degree of legislative power over the affairs of the department. A similar regulation was introduced in the districts and single towns. But by this organization the power of the government was much weakened, and the authorities of the departments often came forward in open opposition to the ministry. It was therefore one of the first operations of Napoleon to restore the intendants—not, however, under this odious name, but under the appellation of *préfets*. This was accomplished by the law of February 17, 1800 (28 Pluv. year VIII.), by which there was established for each department a *préfet* (to be appointed and dismissed at pleasure by the first consul), a council of the prefecture, consisting of three to five members, and a general council of the department. The last, also, appointed by the first consul, was to assemble once a year to distribute the quota of the departmental taxes among the districts (*arrondissements* or *under-prefectures*), to fix the expenses of the department, to decide on remonstrances respecting excessive taxation, and to audit the accounts of the *préfets* respecting the departmental treasury. But it seems that these *conseils généraux de département*, as well as the *conseils d'arrondissement*, were tacitly suffered to fall into disuse. The *préfets* are intrusted with the whole organization and management of the police establishments; but the punishment of offences against the police regulations belongs to particular courts not under their control. Within this sphere of action the *préfets* are

unchecked; the *sous-préfets*, who are appointed by them, and who stand at the head of the districts, are entirely subject to their commands; and the authorities of the communes, as well as the justices of the peace, can set no limits to their activity. In time of tumult they can call out the military, or provisionally declare a state of siege. The courts have no cognizance of any matter which has already been decided by an act of prefecture (*arrêté* of the *préfets*, or council of the prefecture), even though the officers may have exceeded their powers until that act has been voided by the competent authorities. By means of the *préfets* the ministry can exert a great influence, not merely on public, but also on private affairs. How the administration of penal justice, the elections, &c., were managed by them according to the purposes of the ministers, is notorious. The power of the *préfets*, however, ceases, at least by law, as soon as a legal contest arises respecting a subject of administration, for he must refer such cases to the court appointed for the purpose, the council of the prefectures, of which he is the president, but in which he has only a casting vote. Under the cognizance of this court fall all disputes respecting the taxation of particular individuals, respecting contracts for supplies, engagements with the state for building, the indemnification of those who have had to give up anything to the public, or have been injured by the contractors for public buildings, together with injuries sustained in war, contests respecting any of the public domains, &c. The appeals against its decisions (*arrêlés*) lie to the council of state.

PREGNANCY, the state of a female who is with child. Pregnancy begins at the moment of conception, and ceases with that of birth. During pregnancy the vital activity, especially of the womb, which probably receives a few days after conception the fecundated vesicle, increases. The periodical discharge of blood ceases, but the vessels of the womb become enlarged, more charged with blood, longer and straighter. Its cellular substance becomes softer and more spongy, the sides thicker, the cavity wider. It loses the pear shape which it has when not impregnated, and becomes more globular. It sinks during the two first months of pregnancy lower into the pelvis, but afterwards rises and becomes larger, until in the eighth month the bottom of it can be felt externally in the region of the stomach. In the ninth month it sinks again somewhat. In these changes of the womb the embryo (which see) develops itself until it has reached in the fortieth week a sufficient degree of maturity to be able to live separate from the mother, when the birth takes place, and pregnancy is at an end. But the vital activity is increased in the state of pregnancy, not only in the womb, but in the whole body with healthy and vigorous women. Pregnant women are bolder, more independent, more enterprising, stronger than before, and retain those qualities when they are mothers. They are more rarely affected by contagious diseases; consumption is checked during pregnancy, but makes the more rapid progress after its completion. Hysterical women feel often uncommonly well during this period; the gouty are freed from their attacks; some become uncommonly fat. On the other hand, this state is with many, particularly with feeble, sickly, delicate, too young or too old women, often accompanied by a great many complaints which depend upon the altered state of the systems of the vessels and nerves. The stomach particularly often suffers; hence nausea, vomiting, a morbid loathing of or craving for particular dishes, which were till then indifferent. Pregnant women often suffer also by wandering pains, particularly in the teeth, and by

coughing. The pressure of the womb not unfrequently causes irregularities in the discharges of the urine and excrements, and by bearing on nerves and blood-vessels produces pains of various kinds, and impediment to the due flow of blood, evidenced by varicose veins, particularly of the lower extremities. All these changes serve as signs of pregnancy. Other signs are the gradual and regular changes observed at the opening of the womb by internal examination; also the state of the breasts, which become larger during pregnancy, and in which a milky substance collects, but particularly the change of colour round the nipple; lastly, the motion of the child felt by the mother in the second half of the period of pregnancy, and the perception of different parts of the fetus by external and internal examination. It is very important to determine the fact of pregnancy at an early stage; but it is very difficult in some cases, particularly in the first half of the period, because there are a number of diseases of the abdomen which are attended with similar symptoms. Pregnancy itself is subject to a number of deviations from the ordinary course. The rules laid down to prevent injury to the embryo, and to preserve the health of the mother, have reference principally to air, nourishment, and exercise; to the natural desires and preternatural longings (the latter must be gratified with much caution); to the passions, which must be carefully restrained; to the imagination, because the whole nervous system may easily become over-excited; to the proper allowance of sleep, and the disposition of the dress, which must not press either the abdomen or the breast. All injuries from over-exertion or mechanical causes are to be carefully avoided, as falls, lifting, blows, &c., because they may easily occasion abortions. During pregnancy care ought also to be taken that the breasts are fit after the birth of the child to nourish it. It is a mistaken idea that abortions take place much more frequently among the higher classes. The poorer classes in populous cities are quite as liable to them. In the country, where a purer air keeps the body altogether in a more vigorous state, abortions occur less frequently. The advice of experienced female friends during the whole period of pregnancy is of course of the greatest value; yet in almost all countries certain prejudices exist respecting this important state in a female's life, and the advice of a physician cannot be dispensed with. The internal examinations mentioned above are comparatively rare in Britain and the United States, but in France, Germany, and Italy, if not throughout the European continent, they belong to the regular course of medical attendance in the state of pregnancy.

PREGNANCY, CONCEALMENT OF. It is enacted by 24 and 25 Vict. cap. c. (1861) that every person who shall, by any secret disposition of the dead body of a child, whether such child died before, at, or after its birth, endeavour to conceal the birth thereof, shall be guilty of a misdemeanour punishable with imprisonment not exceeding two years, with or without hard labour. If the woman gave notice to the putative father of the child during her state of pregnancy, there is no case against her. A strong case can be made out against the mother if she has made no preparations for her delivery, nor provided clothes for the child.

PREHNITE, a hydrated silicate of aluminium and calcium, containing about 45 per cent. of silica, 25 of alumina, with 25 of lime, and small amounts of potash, oxide of iron, &c. It is most commonly found in trap-rocks in the form of veins and geodes. It is obtained in South Africa, from whence it was first brought by Colonel Prehn; in Scotland; and in many other places.

PRELATE, in church law those spiritual dignitaries who exercise jurisdiction in their own name. These were originally only the bishops, archbishops, patriarchs, and the pope. The cardinals and legates, abbots and priors, also obtained certain privileges of jurisdiction by grant or prescription. In the German Empire, previous to the secularizations of 1803, a number of high ecclesiastics, who held immediately of the emperor, had also a secular jurisdiction, and several had the princely dignity, with a seat and voice in the diets. The term prelates is often used merely to signify the higher dignitaries of the church.

PRELUDE, in music, a short introductory strain preceding the principal movement, performed on the same key as it, and intended to prepare the ear for the piece that is to follow. It may consist of a series of unconnected chords when the intention is simply to attract the attention of an audience, or to fill a singer's ear with the key in which the piece is written, in which case it is generally improvised. It is, however, usually composed of part of the leading theme, more or less varied towards the close, and is not left to the invention of individual performers, but is written by the composer or arranger himself.

PREMISES. See **LOGIC**.

PREMONSTRATIENSIS, or NORBERTINES, a religious order, founded in the French bishopric of Laon by Norbert, a canon of Xanten in Cleves, who, by the austerity and zeal which he manifested as Archbishop of Magdeburg in 1127 acquired the honour of canonization. In the forest of Coucy, in a meadow pointed out to him, as he said, by Heaven (*pré montré, pratum monstratum*; thence the name of the order), he collected his first disciples (1120), and gave them the rule of St. Augustine with some additional rigour. The Premonstratensians therefore consider themselves as regular canons, though by their constitution they are actually monks. Their order increased rapidly; several nunneries were established with the same rigid rules—at first in the neighbourhood of the monasteries, from whose revenues they were supported, but subsequently at a distance from them, to avoid the dangers of intercommunication. The abbot of the original monastery Prémontré, near Coucy, was general, and with three other abbots formed the great council of the fathers of the order. The order was introduced into England in 1146, and its members were there regularly known as the White Canons. Before the Reformation they had 2000 monasteries, among which were 500 nunneries, mostly in Germany, the Netherlands, France, England, and the north of Europe, but the Reformation diminished this number by more than one-half in the sixteenth century. The monasteries in Spain attempted to revive their discipline in 1573 by uniting in a strict observance of their rules, but they remained in communion with those of the common observance. In 1630 this communion of all the monasteries of both kinds was confirmed by new statutes. In the eighteenth century the order had no houses in Italy; in France it had forty-two monasteries; the nunneries had all disappeared. It now consists of a few houses in Poland and Austria, especially Bohemia, with some recently founded elsewhere, as at Crowle and Spalding in Lincolnshire, and Stormington in Sussex.

PRENZLAU, or PRENZLOW, a town of Prussia, on the Ucker, where it issues from the north extremity of Lake Ucker, 57 miles north by east of Berlin. It is divided by the river into an old and a new town, is well built, and has among its buildings a handsome Gothic church (erected 1325-40), a war monument, and a gymnasium. In 1806 a Prussian corps under Prince Hohenlohe surrendered here after the battle of Jena. Pop. (1890), 16,019; (1900), 20,228.

PREPOSITION (from *præpositus*, placed before), a part of speech which is used to show the relation of one object to another, and derives its name from its being usually placed before the word which expresses the object of the relation. In some languages this relation is often expressed by changes of the termination (cases) without the use of a preposition.

PRESBURG. See **PRASSBURG**.

PRESBYTERIANS. The term Presbyterian comes from the Greek *presbuteros*, which signifies elder, and is applied to that body of Christians who hold that there is no order in the church as established by Christ and his apostles superior to that of presbyters, and who vest church government in presbyteries, or associations of ministers and ruling elders, possessed all of equal powers, without any superiority among them, either in office or in order. The Presbyterians believe that the authority of their ministers to preach the gospel, to administer the sacraments of baptism and the Lord's supper, and to feed the flock of Christ, is derived from the Holy Ghost by the imposition of the hands of the presbytery; and they oppose the Independent scheme of the common rights of Christians by the same arguments which are used for that purpose by the Episcopalians. They affirm that all ministers, being ambassadors of Christ, are equal by their commission; that the words presbyter (*presbuteros*) and bishop (*episkopos*) are synonymous and interchangeable terms; and that Prelacy was gradually established upon the primitive practice of making the moderator, or speaker of the presbytery, a permanent officer. These positions they maintain against the Episcopalians by the following arguments. — They observe that the apostles planted churches by ordaining bishops and deacons in every city; that the ministers, who in one passage are called bishops, are in another styled presbyters; that we nowhere read in the New Testament of bishops, presbyters, and deacons in any one church, and that therefore we are under the necessity of concluding bishop and presbyter to be two names for the same church officer. The identity of the office of bishop and presbyter being thus established, it follows that the presbyterate is the highest permanent office in the church, and that every faithful pastor is successor to the apostles in everything in which they were to have any successors. In the apostolic office there were indeed many things peculiar and extraordinary; such as their immediate call by Christ, their infallibility, their being witnesses of our Lord's resurrection, and their unlimited jurisdiction over the whole church. These powers and privileges could not be conveyed by the imposition of hands to any successors; but as rulers and office-bearers in particular churches we have the confession of the 'very chiefest apostles,' Peter and John, that they were nothing more than presbyters or pastors. This being the case, the dispute which has been so warmly agitated concerning the validity of Presbyterian ordination may soon be decided; for if the ceremony of ordination be at all essential, it is obvious that such a ceremony performed by presbyters must be valid, as there is no higher order of ecclesiastics in the church by whom it can be performed. Accordingly we find that Timothy himself, though said to be a bishop, was ordained by the laying on of the hands of a presbytery. At that ordination, indeed, Paul presided, but he could preside only as *primus inter pares*, for we have seen, that, as permanent officers in the church, the apostles themselves were no more than presbyters. If the apostles' hands were imposed for any other purpose, it must have been to communicate those *charismata* or miraculous gifts of the Holy Spirit which were then so frequent, but which no modern presbyter or bishop would scarcely pretend to give.

The first Presbyterian church in modern times was founded in Geneva by John Calvin about 1541; and the constitution and doctrines were thence introduced, with some modifications, into Scotland by John Knox about 1560, though the Presbyterian was not legally recognized as the national religion until 1592. For nearly a century after this date there was a continual struggle in Scotland between Episcopacy and Presbyterianism. The former, which was patronized by the court, was predominant in 1606; but was superseded by the latter, to which the great body of the people were attached, in 1638. At the revolution of 1660 Episcopacy again obtained the ascendancy, which it lost in 1690, when Presbyterianism was finally established in Scotland; and by the Treaty of Union in 1707 it was agreed on the part of England and Scotland that that form of church government shall be the only form of ecclesiastical government in Scotland.—The constitution of the Scotch Church, and with certain unimportant modifications of the Presbyterian Church generally, is as follows:—The kirk-session is the lowest court, and is composed of the parochial minister, or ministers, if more than one, and of lay elders, the number of whom varies in different parishes; the minister, or senior minister, where there are more than one, is president or moderator. This court exercises the religious discipline of the parish; but an appeal may be made from its decisions to the presbytery, the court next in dignity. (See KIRK-SESSION.) The presbytery, from which there is a power of appeal to the synod, is composed of the ministers of a number of contiguous parishes, with an elder from each. A moderator, who must be a minister, is chosen every half year. A presbytery meets generally once a month, but it must at least meet once a year, and it may hold meetings on special occasions (*pro re nata* meetings). This court takes young men on trial as candidates for license; ordains presentees to vacant livings; has the power of sitting in judgment on any of its members, and can depose them; and has the general superintendence of religion and education within its bounds. The synod, which meets twice a year, is formed of the ministers and elders of two or more presbyteries. A moderator, who must be a minister, is chosen at every meeting. The General Assembly is the highest ecclesiastical court (see ASSEMBLY). In 1843 a large number of ministers and people left the Established Church of Scotland and formed the Free Church, a body in almost all respects similar, but not connected with the state. In 1847 was formed the United Presbyterian Church, by the union of two other Presbyterian bodies. The union of the Free and the United Presbyterian Church in 1900 produced the United Free Church. Another Presbyterian Church in Scotland is the Reformed Presbyterian Church.

Presbyterianism has never flourished much in England. In 1572 a presbytery was formed at Wandsworth in Surrey by ministers of London and its neighbourhood, who had separated from the Anglican Church, and several other presbyteries were soon formed, notwithstanding the extreme hostility of Queen Elizabeth. An attempt was made to render the Established Church presbyterian in the reign of Charles I.; and this object was signally promoted by the famous Assembly of Divines at Westminster. In 1649 presbytery was sanctioned by Parliament, but it was never generally adopted, or regularly organized, except in London and Lancashire. About 2000 (though some restrict the number to 800) Presbyterian clergy were ejected from their cures in consequence of the Act of Uniformity in 1662. Under the influence of such thinkers as Milton, Sir Isaac Newton, Locke, and Priestley, the more intelligent members of the Presbyterian Church were drawn

towards Socinianism or Unitarianism, to such an extent that the name Presbyterian in England became synonymous with Unitarian; and many old endowments, the legacies of Presbyterians, are enjoyed by the Unitarians at the present day. In 1876 a large number of Presbyterian churches in England joined to form the Presbyterian Church of England.—The Presbyterian Church in Ireland originated through the settlement of some Scottish colonists in Ulster in the reign of James I. The members were not tenacious about matters of church polity, for some of the pastors received ordination from the hands of a bishop, and the people conformed without scruple to some of the ceremonies of the Established Church. The ministers were admitted at first to the privileges and emoluments of their Episcopalian brethren. In the reign of Charles I., and during the administration of Laud, the interests of the Irish Presbyterians suffered considerably; the statutes of the college at Dublin, authorizing the admission to its privileges and honours, were remodelled; their confession recognized in 1615 was set aside, and their ministers were ejected from their charges for nonconformity. During the Protectorate they were again raised to the status of ministers of the National Church. When Charles II. attempted to force Prelacy upon the Scotch, many of them took refuge in the north of Ireland, which gave the cause of Presbyterianism in that country a fresh impulse. This was not diminished by the accession of William of Orange to the British crown, for he had been educated in Holland to a decided preference for the doctrines and discipline of Presbyterianism. Nor did subsequent events tend to lessen his respect for the adherents of that system in Ireland; for when James II. landed there the Presbyterians rallied around the standard of the Protestant champion, and by their memorable defence of Londonderry, as well as the assistance they rendered at the battle of the Boyne, mainly contributed to the success of his arms. As a test of his gratitude he doubled the sum given for the support of their ministers, hence known as *Regium Donum*. This sum was repeatedly augmented until it reached the sum of £70 a year for each minister. The act of 1869, however, which disestablished the Irish Church, provided also for the discontinuance of this sum. Like their brethren in England, the Irish Presbyterians showed during the eighteenth century a decided leaning towards Arianism or Unitarianism. In 1830 a separation took place from the Arians, who then formed the Remonstrant Synod of Ulster. Ten years later a union was effected of the Presbyterian Church, forming the Synod of Ulster, and the Secession Church in Ireland, an offshoot of the Secession Church of Scotland.—The Presbyterian Church of the United States is undoubtedly to be reckoned as a daughter of the Church of Scotland. Presbyterians in large numbers began to emigrate from Scotland and the north of Ireland to the American colonies as early as 1639, and they quickly manifested a disposition to reproduce their peculiar institutions in their new homes. There were several churches established before the close of the century. The church of Rehoboth in Maryland dates from 1690, and the church on Elizabeth River in Virginia is believed to have had as early an existence. In 1705 or 1706 a presbytery was first formed in Philadelphia, and in 1716 a synod composed of four presbyteries was formed. The body rapidly increased by means of emigrants not only from Scotland and Ireland, but from Wales, France, Holland, and Switzerland. The consequence was that the church soon began to assume a rather heterogeneous character, and the harmony of its operations was proportionately diminished. The existence of two distinct parties could be clearly

recognized: those who were more jealous for orthodoxy, for a rigid adherence to Presbyterian rule, and for a thoroughly-educated ministry were called the old side; while those of the new side looked upon departures from ecclesiastical order with more forbearance, and were less particular in respect to other qualifications for the ministry provided they could have evidence of genuine piety. Violent dissensions ensued, and at last, in 1741, the synod was rent asunder, the old side constituting the Synod of Philadelphia, and the new side the Synod of New York; but seventeen years later they were united. In 1788 a General Assembly was instituted, composed of the four synods of New York and New Jersey, Philadelphia, Virginia, and the Carolinas. In 1801 a plan of union between the American Presbyterian Church and Congregationalists was formed, with a view to prevent disagreement between the two denominations, and under this arrangement numerous churches were founded in the states of New York and Ohio. In 1836 another division broke out in the church, which was split up into two distinct and independent sections, known as the Old School and New School Presbyterians; this was followed in 1869 by another reunion. Besides the Cumberland Presbyterians (a secession from the main body dating from the beginning of the nineteenth century), there exist in the United States numerous churches connected with the various denominations of Presbyterians in Scotland.

PRESCOT, a manufacturing and market town of England, in Lancashire, 8 miles east of Liverpool and 3 miles south-west of St. Helens. It has long been noted for its manufactures of watch movements and accessories, and is now the principal seat of the watch-making industry in England. Files of superior quality are also produced in large quantities, and the British Insulated Wire Company Limited has now extensive works in the town. Among the buildings and institutions are an old parish church with some monuments, several modern churches and chapels, a grammar-school, reading-rooms and library, almshouses, &c. Cattle and other fairs are held annually. Pop. in 1891, 6745; in 1901, 7855.

PRESCOTT, WILLIAM HICKLING, a noted American historian, was born in Salem, Massachusetts, on 4th May, 1796. His father, William Prescott, was a lawyer of considerable standing, and the son of Colonel William Prescott, who commanded the American forces at the battle of Bunker's Hill. Young Prescott continued at Salem till the twelfth year of his age, when his father removed to Boston. In 1811 he entered Harvard College, and graduated in 1814. In the last year of his college life a class-mate playfully threw a crust of bread at him, which struck him on the eye, completely depriving him of its use for ever afterwards. Excessive use of the other eye for study brought on a rheumatic inflammation, which left him entirely blind for several weeks, and rendered the eye too irritable to be employed in reading for several years. Subsequently he was able to use it for many hours a day, but it eventually became so weak, that during the latter half of his life he could read only for a few moments at a time, and could scarcely see to write at all. He had early resolved to devote himself to a literary life, and soon after leaving college proceeded to Europe, and spent two years in travelling through England, France, and Italy. He then returned to his native country, where he married, and set himself assiduously to literary labour. The earliest fruits of this were contributions to the North American Review, principally on Italian and French literature, but the subject for which his inclination and abilities more especially fitted him was history, and he accordingly selected for his first attempt the reign of Ferdinand

and Isabella of Spain, a work on which was published in three volumes, at Boston, on the Christmas-day of 1837 (but dated 1838), under the title of the *History of the Reign of Ferdinand and Isabella the Catholic*. The success which this achieved was most decisive. It was received with the utmost enthusiasm both in America and Europe; it was rapidly translated into French, Spanish, and German; and its author was elected a member of the Royal Academy of Madrid. The popularity of the work continues undiminished, as is evinced by the numerous editions through which it has passed.

Mr. Prescott's next work was the *History of the Conquest of Mexico*, with a Preliminary View of the Ancient Mexican Civilization, and the Life of the Conqueror Hernando Cortez, which appeared in three volumes in 1843, and was received with an equal degree of favour to that which had greeted his *History of Ferdinand and Isabella*. In 1847 appeared, in three volumes, the *History of the Conquest of Peru*, with a Preliminary View of the Civilization of the Incas, like his previous writings a work of sterling merit.

A more extended work was now contemplated by Mr. Prescott, and the *History of the Reign of Philip II.*, which he did not live to complete, was commenced. This he intended should be a *chef d'œuvre*, and no pains nor expense were spared by him to render the result commensurate with the undertaking. In connection likewise with the most extensive preparations made by himself, he received the most liberal co-operation from all quarters, public and private. Everywhere both public and private collections were thrown open to his inspection. In 1855 the first two volumes of the long-expected work appeared under the title of the *History of the Reign of Philip II., King of Spain*, and proved, on examination, that the anticipations of the public regarding it had neither been overstrained nor illusory. Like the former writings of Prescott, this history displays the same clear and lucid style, the same impartiality and research, and the same picturesque and fascinating interest of narrative.

In 1856 Mr. Prescott published an edition of Robertson's *History of the Reign of Charles V.* with notes and supplement, containing an account of the emperor's life after his abdication. In the end of 1858 appeared the third volume of the *History of Philip II.*; but the earthly career of its author was now almost completed. In the commencement of the last-mentioned year he had been visited by a slight stroke of paralysis, but this had yielded to the efforts of his physicians, and he seemed to have recovered his usual health and spirits. On the 28th of January, 1859, however, he was suddenly seized with apoplexy, and expired in about an hour and a half afterwards. He left a widow and three children, two sons and a daughter.

The labours of Prescott afford a remarkable instance of the success of indomitable industry and perseverance carried out in the face of what might otherwise appear almost insurmountable obstacles. Precluded by his affliction of partial blindness from consulting personally the authorities from which he drew his materials, he was in the practice of causing them to be read aloud to him by another. His first reader knew, however, no language but English. The historian 'taught him,' as he says, 'to pronounce the Castilian, suited, I suspect, much more to my ear than to that of a Spaniard. I cannot even call to mind without a smile the tedious hours in which, seated under some old trees in my country residence, we pursued our slow and melancholy way over pages which afforded no glimmering of light to him, and from which the light came dimly struggling to me through a half

intelligible vocabulary. . . . When we had toiled our way through seven quartos I found I could understand the book (Mariana's History) when read about two-thirds as fast as ordinary English.' He afterwards obtained the services of a reader acquainted with several of the continental languages. Prescott's mode of composition was as follows. His secretary first read to him all the books treating on the general subject, the historian dictating occasional memoranda as the reading went on. The plan of the work was then sketched, a division into chapters made, and the authorities for the topic of the first chapter gathered together and read to him carefully while he dictated notes of their contents. When the mass of these notes was read and re-read to him he sat down to write, using for this purpose a writing instrument consisting of a frame of the size of a sheet of quarto letter-paper traversed by as many brass wires as there were to be lines on the page, and with a sheet of carbonated paper, such as is used for getting duplicates, pasted on the reverse side. With an ivory or agate stylus he traced rapidly but rather illegibly the characters between the wires on the carbonated sheet, making indelible marks on the white page below. His secretary copied the manuscript as fast as it was written, and when the chapter was finished it was read to him several times, carefully revised, and again copied before being sent to the printer. He found this writing-case his best friend in his lonely hours, and with it he wrote nearly all that he sent into the world for the last forty years of his life. A life of this great historian, and amiable and pure-minded man, was written by his friend George Ticknor, and published in 1864. His contributions to the magazines were collected under the title of *Biographical and Critical Essays* (New York, 1845; London, 1861). A complete edition of his works has been published in 15 vols. (new ed. 1890).

PRESCRIPTION, in law, is a right or title acquired by use and time, as when a man can show no other title to what he claims than that he, and those under whom he claims, have *immemorially* used to enjoy it. The object of prescription is to secure the title to property to him who has had the possession of it for the term fixed by the law, and to prevent any one from disturbing his possession after such term has expired. The law of prescription is not intended to punish the indolence of proprietors; it only interprets their silence as consent, presuming that a man who neglects to assert his right for a long series of years gives it up. In the English law the term *prescription* is applied only to incorporeal hereditaments, as a right of way, a common, &c. A prescription is distinguished from a custom by this, that custom is properly a local usage, and not annexed to a person, such as a custom in a manor, that land shall descend to the youngest son; but prescription is merely a personal usage; as that a certain man and his ancestors, or those whose estate he hath, have used, time out of mind, to have common of pasture in such a close; for this is a usage annexed to the person of the owner of this estate. By the law of England a prescription must have existed from time whereof the memory of man is not to the contrary, which is to be understood not merely of living memory, but of memory by means of records or other written memorials; and, therefore, where there is any proof of the original or commencement of anything, it cannot be claimed by prescription; unless, indeed, the commencement were before the reign of Richard I., for then it is considered to have existed immemorially, on an equitable construction of the statute of Westminster, 1, which limited that time for a writ of right. This continued to be the rule at common law till the passing of the

statute 2 and 3 William IV. cap. lxxi., which provides that no right of common shall be defeated after thirty years' enjoyment, and after sixty years the right is deemed absolute and indefeasible, unless had by consent or agreement. In claims of right of way, of watercourse, and similar easements, the periods are twenty and forty years. Claims to the use of light to any dwelling-house or building enjoyed for twenty years are indefeasible, unless shown to have been by consent.

By the law of Scotland prescription has a much wider operation than by the law of England, supplying the place of the statute of limitations of that system. It not only protects individuals from actions which other parties might have brought against them had the lapse of time not taken place, but in some instances creates a positive title to property. The prescription by which a right of property can be established is that of forty years. Whatever adverse right is not cut off by the other special prescriptions of shorter periods is destroyed by the long prescription, as this is called. To create a title to real property, the long prescription must be both positive and negative. The party holding the property must by himself, or those through whom he holds, have been forty years in unchallenged possession, and be able to show an infetment or series of infetments. The claimant and those whom he represents must have been forty years without an ostensible title, and must, by not legally challenging it, have tacitly acquiesced in the possessor's title. A period of twenty years is now sufficient for a prescription in certain cases. Prescription is interrupted by an action raised in a competent court, and is suspended by the minority of any person who could challenge the opposing right; in the first case a new period of forty years has again to run, and in the second the years of the minority are not counted in making up the forty. The other and shorter prescriptions (called the *lesser prescriptions*) are as follows:—The *vicennial* or twenty years' prescription, applicable to holograph writings not attested with the usual solemnities of Scottish writs; the *decennial* or ten years' prescription, applicable to actions against tutors and curators; the *septennial* or seven years' prescription, applicable to actions against cautioners; the *sevvennial* or six years' prescription, applicable to bills of exchange or promissory notes; the *quinquennial* or five years' prescription cuts off all right of action on verbal contracts, and arrears of rent in an agricultural lease; the *triennial* or three years' prescription, which cuts off claims for ordinary merchants' accounts, servants' wages, rent due on a verbal lease, and for services rendered by attorneys, surgeons, artificers, &c. By Scotch law also, but not by English, a *vicennial* prescription applies to crimes, no prosecution being competent after a period of twenty years.

PRESCRIPTION, in medicine, is the form, with directions, in which a medicine or medicines are ordered or prescribed by a medical man. In England both prescriptions and directions are usually written in Latin; in Scotland the directions are generally given in English. In prescribing the physician may, from the nature of the case, use an official or extemporaneous preparation. Official preparations are those for which formulæ have been introduced into the national pharmacopœias, and which are supposed, therefore, to be kept ready for use by all respectable dispensing chemists. In former times prescriptions were much more complicated than they are now, and certainly the simplicity may be regarded as a sign of increased medical knowledge and of greater confidence in the action of medicines. Some persons even contend that there should be no intermixture of medicines, but that one only should be given with a certain definite object, and allowed

to operate unembarrassed by the presence of others. This, however, would materially interfere with the efficiency of practical medicine, at least in the present state of our knowledge. The several medical substances which may be contained in a prescription are distinguished by medical writers by names indicative of the office which each of them performs. These are—1. The *basis*, which is the principal or most active ingredient. 2. The *adjuvant*, or that which is intended to promote the action of the basis; as tincture of senna added to infusion of senna in the ordinary black draught. 3. The *corrective*, intended to correct, modify, or control its action; thus, the addition of extract of hyoscyamus to the compound extract of colocynth renders the purgative action of the latter much less griping, yet not less efficacious. 4. The *excipient*, or that which gives the whole a commodious or agreeable form, and which, consequently, gives the prescription its peculiar character, as that of draught, mixture, pills, &c. To these certain continental writers add a fifth, the *intermedium*, which is the substance employed to unite remedies which do not mix with each other or with the excipient, such as yolk of eggs and mucilage, employed in the preparation of emulsions. In choosing the form of a prescription it should be borne in mind that solutions and emulsions generally act with more certainty and rapidity than powders diffused through water; and these again than the semi-solid and solid forms of medicine represented by electuaries, boluses, and pills. On these matters the taste and wishes of the patient should not be disregarded. The taste of nauseous medicines should be disguised as much as possible by the judicious selection of an appropriate corrective or excipient; thus the disagreeable flavour of Epsom salt may in a great measure be covered by dissolving it in peppermint-water, that of aloes by liquorice, that of castor-oil and cod-liver oil and copaiba by orange wine or water containing a bitter tincture; the bitterness of all bitter substances is concealed by strong coffee or tea.

PRESENTATION means the nomination of one or several candidates to a vacant office, as in the case of a patron to a church. Presentation is properly speaking merely a proposal, but when given by the true patron cannot be rejected except on cause shown. The investiture or induction, however, belongs to the person or body before whom the presentation is laid. In ecclesiastical benefices the usual rule is that if the patron fails to present within six months after a vacancy has been intimated to him, the *jus devolutum* takes place; in other words, the patron loses his right, which in consequence devolves on the party before whom the presentation should have been laid, as the bishop under Episcopacy, and the presbytery under Presbyterianism.

PRESENTMENT, in law, is properly speaking the notice taken by a grand-jury of any offence, from their own knowledge or observation, without any bill of indictment being laid before them at the suit of the crown; as the presentment of a nuisance, a libel, or the like, upon which the officer of the court must afterwards frame an indictment before the party presented can be put to answer it. The term is also used to include inquiries of office, and indictments by a grand-jury; or to express the formal notice taken in copyhold courts of the deaths of tenants, surrenders and admittances taken out of court, and similar circumstances.

PRESERVED PROVISIONS, PRESERVES. The tendency of all dead organized matter which contains moisture is, at ordinary temperatures, to undergo chemical change, or in other words, the various vegetable and animal products, when deprived of life, decay. (See **DECOMPOSITION, PUTREFACTION.**) When

these products are such as are employed for food, it of course becomes a matter of considerable importance to counteract this tendency to decomposition, by which the articles are speedily rendered useless. Fruits intended for confectionary are preserved in four different ways—1. In the form of jam, in which the fruit is boiled with from one half to about equal its weight of sugar. 2. In the form of jelly, in which the juice only is preserved, by being carefully strained from the solid portions of the fruit, and boiled with a third to a half its weight of sugar. 3. By candying, which consists in taking the fruits whole or in pieces, and boiling them in a clear syrup previously preserved. They absorb the syrup, which is then crystallized by the action of a gentle heat. 4. By stewing them in a weak syrup of sugar and water till they become soft but not broken, and transferring with the syrup to jars, adding pale brandy equal in quantity to the syrup. In this way stone fruits, such as cherries, peaches, and plums are preserved. Several kinds of vegetables, as cabbages, cucumbers, cauliflowers, onions, are preserved by pickling. (See **PICKLES.**) But to preserve large quantities of vegetable and animal products for food-purposes, so as to be used as nearly as possible as if they were in the fresh state, they must be either desiccated, or sealed in air-tight cases. With vegetables, which contain so large an amount of water in proportion to their solid and nutritious material, the process of drying is peculiarly applicable, and seems likely to be largely employed as the means of furnishing fresh vegetable food for ships in a compact and portable form, when, in addition to desiccation, compression is also employed. Vegetables such as cabbage, beans, pease, pursnips, sliced carrots, Brussels sprouts, squash, potatoes, &c.; and fruits such as apples, pears, &c., are preserved by removing all the moisture from them, by drying either in a vacuum or by means of heated air, which reduces their bulk in many cases more than one half. They are then submitted to the action of powerful presses, which, besides again reducing their bulk considerably, makes them less liable to absorb moisture from the atmosphere. When vegetables thus prepared are immersed in water for some time they swell up, become soft and tender, and resume to a great extent the appearance, colour, and flavour proper to them in their fresh state. It is stated that 1 cubic yard of these dried and compressed vegetables contains as much as 16,000 rations, and that they are of better flavour and much cheaper than the vegetables preserved in canisters. The action of an elevated temperature, such as is employed in cooking food, must be regarded rather as a retarder than as a perfect preventive of putrefaction. When heat is combined with dryness it acts much more perfectly as a preservative. This is exemplified in the processes employed originally by the Indians of North and South America. See **JERKED BEEF** and **PEMMECAN**.

The preservation of articles of food by the application of cold is the simplest of all known methods, and in such climates as North America, Russia, &c., it is largely taken advantage of. Cattle and poultry are killed at the commencement of frost, allowed to become frozen throughout, and in this condition are brought to the markets of Montreal, Archangel, St. Petersburg, &c.; fish are treated in the same way. Provisions thus preserved only require the precaution of being gradually thawed before use by immersion in cold water. During the hot season, of course, animal food cannot be preserved in this way, but ice serves the same purpose as frost, and, as is well known, it is largely used to pack salmon and fish generally in summer time.

One of the most extensive methods of preserving

provisions is by their impregnation with salt, and it proves an excellent preservative when employed in the best manner, as in combination with smoking. Hams are preserved or *cured* in immense quantities by the process of salting and smoking, fish by salting and drying alone. The preserving of meat in brine is a less satisfactory method. Muscular tissue, of which flesh is composed, consists mainly of *fibrin*, in a coagulated or semi-solid condition, and is permeated in all directions by a fluid composed partly of blood, and partly of substances secreted from it. This fluid, which constitutes nearly three-quarters, by weight, of all fresh meat, is composed of albumen in the soluble condition, the soluble salts of the blood, the crystallizable animal principles kreatine and kreatinine, &c. By the process of brine salting these important substances are washed out, and in course of time nothing is left but hard fibrin, which affords little nourishment. A change in the gastric juice, and consequently in that of the products of the digestive process, must be regarded as an inevitable result of the long-continued use of salted meat; and if, during digestion, the substances necessary to the transformation of that species of food be taken from other parts of the organism, these parts must lose their normal condition.

From the above objections the process of preservation by exclusion from the action of atmospheric air is free, and is yearly assuming more importance and being more largely practised. The action of the atmosphere may be prevented in different ways; as by covering the articles with melted fat, immersing them in treacle, glycerine, weak vinegar, and several other liquids, but from one cause or other these methods have all failed practically. Sardines and other small fish have been preserved in oil in large quantities with success, but the principle, though sound, is from the expensive nature of the material inapplicable to provisions in large bulk. The most perfect method, and that which is now most generally resorted to, is the inclosure of the food in air-tight cases from which the air is then expelled; upon the perfection of the air-excluding process depends entirely the preservation of the article. The first successful attempt to preserve fresh meat was made by M. Appert, a Frenchman, who received, in 1810, a prize of 12,000 francs offered by the Board of Arts and Manufactures in Paris. The following year his colleague M. Durant took out a patent for the process in Great Britain. This patent was purchased for £1000 by Messrs. Donkin, Hall, & Gamble, who at once effected a great improvement in Appert's method by substituting tin canisters for the glass cases formerly used. The plan now generally adopted is, with some modifications, as follows:—The provisions, of whatever kind, are packed into a tin cylinder, and the interstices filled in with water or other appropriate fluid, as gravy in the case of flesh-food. The lid, which is perforated with a small aperture or pin-hole, is soldered carefully down. The cases are then set in a water bath in which muriate of lime is dissolved, and heat is applied until the whole boils, and the air is expelled through the pin-holes. These holes are then hermetically closed, and the canister and its contents are once more subjected to the operation of heat until the provisions are perfectly cooked. When it has become cool the canister is coated over with paint and removed to the proving room, an apartment the temperature of which has been raised to the degree of temperature most favourable to decomposition. If the operation has been successfully performed, the ends of the canisters, and in some instances the sides, will have fallen in to some extent from the outward pressure of the air. If, after the interval of some days, the

ends are found to have bulged out, it is a certain sign that the contents have not been perfectly cured, or that the case has not been properly soldered; the liberated gases causing the outward pressure. Such cases should be rejected or submitted again to the process. Not only may boiled provisions be preserved in this way, but with a little more care roast meats also. An improvement on this process has been effected by introducing into the canisters a small quantity of sulphite of soda, which causes the absorption of any traces of free oxygen which may lurk in the cases.

In recent years several methods of preserving meat in a frozen state have been introduced, and apparatus for the purpose have been fitted up in vessels intended for the conveyance of frozen beef and mutton, cargoes of which are now brought from America, the Australian colonies, and elsewhere, to Britain. At several of the London docks immense vaults and chambers have been constructed for temporarily storing such meat on its arrival, air being supplied to them at a temperature as much as 20 degrees to 40 below freezing-point. A general feature of such refrigeratory contrivances fitted up on board ships is an air-tight room in which the meat is kept, and through which dry cold air is made to circulate by means of special machinery driven by steam, the air being first compressed and cooled, and a further cooling taking place when it is again allowed to expand. Many vessels now have these refrigerators merely for keeping provisions for the passengers and crew in a fresh state. The making up of meat for exportation in canisters is now most extensively carried on in America, and it is largely in consequence of the increased activity of this branch of trade there that the imports into Great Britain of beef and other kinds of meat preserved otherwise than by salting had increased from 171,373 cwt. in 1875, to 560,581 cwt. in 1882. An immense increase has since taken place, and in 1900 the import of fresh mutton alone, mostly frozen, amounted to 3,392,850 cwt. The total value of dead meat of all kinds imported was £36,149,900. The manufacture of extract of meat is now largely carried on. See EXTRACT OF MEAT.

PRESS, CORRECTION OF THE. See CORRECTION OF THE PRESS.

PRESS, LIBERTY OF THE, the liberty of every citizen to print whatever he chooses, which at the same time does not prevent his being amenable to justice for the abuse of this liberty. To make the liberty of the press real two things are essential: 1, that the laws against its licentiousness should be precise and clear; 2, that they should only punish what is really injurious to the public welfare. The laws for punishing abuses of the press are generally directed against attacks upon the government or its officers, upon the reputation of individuals, and upon good morals and religion. The latitude allowed to the press of course will vary with circumstances. A discussion will be permitted in Prussia which would be punished in Austria. Discussions of certain religious topics are considered in one age blasphemous, while another age esteems them innocent. As to charges affecting the character of governments and individuals we may observe that the freer a government is the less sensitive it is, and the less sensitive are the people who live under it. No people are so indifferent to being publicly spoken of as the British, whilst the Prussian code contains many laws against verbal offences. As the liberty of speech is unquestioned, and printing only gives permanence and circulation to what might be freely spoken (newspapers, for instance, take the place of speeches and conversations in the forums of the petty states of antiquity), the right of printing rests on the same

abstract grounds as the right of speech; and it might seem strange to a man unacquainted with history that printing should be subjected to a previous censorship, as it is in some states, any more than speaking, and that the liberty of the press should be expressly provided for in the constitutions of most free states. But when we look to history we find the origin of this, as of many other legislative anomalies, in periods when politics, religion, and individual rights were confusedly intermingled. It is only since men's views of the just limits of government have become clearer that the liberty of the press has been recognized as a right; and to England we are particularly indebted for the establishment of this principle, as of so many other bulwarks of freedom, though the Netherlands preceded her in the actual enjoyment of the liberty of the press. When we consider the practical effect of the censorship, it is no more defensible on that ground than on the ground of abstract right. In what times and countries have morals and religion, and the reputation of individuals, been more outrageously attacked through the press than in those in which the censorship was established? We are far from considering the liberty of the press as without evil consequences; but the censorship does not prevent these consequences, while it destroys the numberless benefits of an unshackled press. But the liberty of the press, properly considered, is not to be treated as a mere question of political expediency. Liberty of conscience and liberty of thought are rights superior in importance to any objects which fall under the head of expediency. Representative governments are empty forms without the liberty of the press. The free discussion of all political measures, and of the character of public officers, is of much more consequence than the freedom of debate in legislative assemblies. A parliament would be a comparatively small check upon a government were it not for the liberty of the press. In fact, it might easily be made an instrument for enforcing oppressive measures; since a government would find little difficulty in gaining over a majority of such a body by the motives of ambition and avarice, were it not for the control exercised over legislative bodies by a free press. Without this publicity of discussion in legislative assemblies would be of little avail. This liberty is the great safeguard of all others; and two French dynasties have been prostrated in a struggle with this formidable power. Polignac's Report, which caused the revolution of 1830, will ever be memorable in the history of the liberty of the press, as proving the difficulty or impossibility of a minister's ruling in opposition to public opinion in a country where the press is free.

In England the liberty of the press, soon after printing was introduced, was regulated by the king's proclamations, prohibitions, charters of license, &c., and finally by the court of Star-chamber. The Long Parliament, after their rupture with Charles I., assumed the same power. The government of Charles II. imitated their ordinances, and the press did not really become free till the expiration of the statutes restricting it in 1693, after which it was found impossible to pass new laws in restraint of it, and it has remained free ever since. In the article BOOKS (CENSORSHIP OF) an account is given of the regulations of various countries for restricting printing and the sale of printed matter. Where the government has the complete control of either no liberty of the press exists. In other countries the principal rules for the regulation of the press are: 1, that all presses must have a license; the printers must often give high security for their loyal behaviour, and sometimes even take an oath; 2, the name and place of residence of the printer must be men-

tioned on the title-page or on the last leaf. This is the case in Great Britain and on the continent of Europe. The printer must keep a list of all that he prints, and in some states must send copies to the government before publication. In France, if a work is found illegal, a criminal process is instituted, and the books are not allowed to be sold until the decision is given. Government need not prosecute immediately, but can at any time. By English law the publisher of a newspaper must, under a penalty of £20, enter into a recognizance or bond of £400 or £300, together with sureties to pay any fine that may be inflicted on him for publishing a blasphemous or seditious libel. Before publication he must also state the correct title of the newspaper, together with the names of the printer, publisher, and, under certain reservations, those of the proprietors. In the United States there is no restraint upon the liberty of printing. Any man can print and circulate whatever he chooses, and is only answerable if the matter itself is illegal. What publications are punishable will depend in some measure upon the circumstances of the particular state in which they appear. In the slave-holding states, publication likely to excite commotions among the blacks were punishable. See PRINTERS (LAW RELATING TO).

PRESS, PRINTING. See PRINTING.

PRESSBURG, or PRESSBURG (Magyar, *Pozsony*; Slavonic, *Presburch*), a town in the west of Hungary, capital of the county of its own name, 35 miles east of Vienna, on the left bank of the Danube, which here divides into several branches, and is crossed by a new iron bridge. The site of the town is remarkably fine, being in the form of a semicircle, bounded on the south by the Danube, from the banks of which it gradually ascends to the west and north towards ramifications of the Carpathians; while an extensive plain, covered with gardens, vineyards, meadows, and corn-fields, forms its boundary on the east. In the town itself there is not much to attract attention. The fortifications have been dismantled, and the streets are for the most part narrow and steep, and only partially paved. The houses, however, are solidly built of brick or stone, and of two or three stories; and some of them, particularly in the suburbs, are very handsome. The edifices most deserving of notice are, the royal palace, on a height which overlooks the town, a building once of great magnificence, and still rich in historical recollections, but accidentally burned in 1811, and not since repaired; the Landhaus, or Hall of the Diet, in which the chambers of the kingdom used to meet, a plain structure; the cathedral, a huge Gothic pile with a lofty steeple, and less remarkable as a church than as the place where the kings of Hungary were formerly crowned; the Capuchin, Franciscan, and Ursuline monasteries, each with a handsome church attached; the Jesuit church, a synagogue, the town-house, theatre, bishop's palace, orphan hospital, and barracks. The manufactures consist of woollens, silks, leather, and tobacco. The trade, particularly transit, and chiefly in corn, is extensive. Outside the town there used to be an artificial mound called the Coronation Hill, to which the newly-crowned kings of Hungary used to ride in grand procession and brandish the sword of St. Stephen towards the north, south, east, and west, signifying thereby that they undertook to defend the kingdom from danger, come from which quarter it might. Pressburg is a place of very great antiquity, and is said to have acquired some importance even before the country was subjugated by the Romans. It is certain that Duke Wratislaw possessed a castle here in the ninth century. In 1541, when the Turks captured Buda, it became the capital of Hungary, and retained the honour till the

Emperor Joseph II. restored it to Buda. The peace by which Austria ceded Venice to France and the Tyrol to Bavaria was concluded here in 1805. Pop. (1900), 65,867, fully more than half of whom are Germans. German is the prevalent language, the Magyar being cultivated only in the upper circles of society.—The county, area about 1250 square miles, is traversed by part of the Carpathian chain in the north, but in other directions is flat and tolerably fertile, though in several quarters covered with marshes. It is watered by the Danube, March, Waag, and Dudwaag, and yields corn, excellent wine, and abundance of wood. Pop. 331,370.

PRESS-GANG, the name given in England to a detachment of seamen who (under the command of a naval officer) were empowered, in time of war, to take any seafaring men and oblige them to serve on board the king's ships. See **IMPRESSMENT**.

PRESSURE. When a body rests on the ground, at the surface separating it from the ground there are two equal and opposite forces acting, the weight of the body acting downwards, and an equal upward force, which may be called the resistance of the ground. Two equal and opposite forces of this kind distributed over an area are called a pressure, and dividing either of the forces by the area gives the mean pressure per unit area. It is customary to call the pressure existing at any cross section of a rod, or wire, or rope, which forces tend to make longer, a 'pull,' and to call the pressure at a cross section of a rod or beam or column, which the forces tend to make shorter, a 'push.' Thus we have the 'intensity of a push,' or of a pull, per unit area. At any little interface separating two small portions of a mass of fluid, or of a solid and a fluid, there is a pressure whose direction at any point is normal to the interface; the intensity of this pressure is its amount per unit area.

PRESTER JOHN (**PRIEST** or **PRESBYTER JOHN**). In the middle ages it was reported by travellers that there was a Christian prince who reigned in the interior of Asia under this name, and the same story was also known to the Crusaders. Albert of Aix and Otto of Freisingen speak of him in the twelfth century; Rubriques, in the thirteenth century, attributes the name of *Prester John* to a Nestorian prince, Ung or Ungh Khan, who had reigned in Karakorum over two Mongol tribes, and perished in a war against Genghis Khan, above half a century before the time of his journey. Other travellers of the thirteenth century also mention this personage, and Giovanni di Montecorvino, bishop of Cambalu, is said to have converted (1305) a prince of his house to Christianity. Who this Prester John was it is not easy to decide; the supposition that he was the Dalai Lama or one of the chief priests of the Lamasites, does not agree with the position assigned to his residence by the travellers, nor does any of the etymological explanations which have been proposed seem satisfactory. The most ludicrous mistake on this subject was that made by the Portuguese in the fifteenth century, who picked up a story of a Christian prince in the interior of Africa, whose name was Ogan, and who was in fact the negus (king) of Abyssinia. In consequence of the resemblance of the names *Ogan* and *Ung Khan* they transferred the throne of Prester John from Asia to Africa, and gave the name to the Abyssinian prince.

PRESTO (Italian), quick, used in music to designate a faster rate of movement than is indicated by *allegro*. *Presto assai* denotes very quick, and *prestissimo* the highest degree of quickness.

PRESTON, a manufacturing and market town, a mun., parl., and county borough of England, in Lancashire, 28 miles north-east of Liverpool, agree-

ably situated on a height above the right or north bank of the Ribble, near the head of its estuary, and on the London and North-western and other railways. It consists of ten principal and a great number of minor streets. The houses are almost all substantially built of brick, and the town is on the whole well laid out. The environs of the town exhibit much pleasing scenery, and are adorned with numerous handsome villas and public walks and parks. The ecclesiastical edifices include a number of established churches, besides Roman Catholic and other chapels. Among the former Christ Church is admired for the purity of its Norman architecture; and the parish church, which has been rebuilt in the decorated style of the fourteenth century, with a spire 196 feet high, is also a fine building. Among the places of worship should be mentioned St. Walburge's Roman Catholic chapel, which has a beautiful spire 306 feet high, and ranks as the most splendid place of worship in Preston. The other more important buildings are the town hall, a handsome stone edifice in the Gothic style, erected in 1862-67, with a lofty clock tower; court-house, well situated, and built in the Doric style; a new infirmary, the house of correction, the custom-house, corn-exchange, new gas-offices, large and handsome market-shed, extensive barracks, workhouse, theatre, and assembly-rooms. The river is spanned by five bridges, two of them large, one of which cost £40,000. A railway station has been built at a cost of about £200,000. The scholastic and literary establishments include a free grammar-school; the blue-coat, commercial or middle, and various national and infant schools; the Literary and Philosophical Institution, provided with a library and museum; the Harris Institute of Literature, Art, Science and Technical Instruction (formerly the Mechanics' Institute, and now greatly enlarged); the Free Public Library and Museum, in the Grecian style, with many valuable paintings, &c. The town is supplied with water from reservoirs situated near Longridge, 17 or 18 miles to the north-east of Preston, capable of storing 405 millions of gallons, and formed at a cost of about £460,000. On the south side of the town are two beautiful public parks, the one 40 acres in extent, the other 12 acres, and on the north side of the town is the Moor Park, which has an area of 90 acres.

The original staple manufacture of the town was linen, which is still woven, but has been completely eclipsed by the cotton manufacture, which, first introduced in 1777, now employs a great many mills for spinning and weaving. There are steam saw-mills and electrical engineering works. Other branches of manufacture are carried on in numerous machine shops on an extensive scale, iron and brass foundries, railway-carriage works, breweries, malt-houses, roperies, tanneries, &c. A considerable shipping trade is carried on, though it was long obstructed by the condition of the Ribble. Since 1884 plans have been carried out under the municipal corporation for the deepening and the diversion of the river for a certain part of its course, and the formation of a dock of 40 acres, besides two graving-docks and a timber-pond of 25 acres, with the necessary approaches, basins, gates, &c., and a very considerable increase in the trade has now taken place.

Preston dates its foundation from a very early period, and is said to have risen on the decay of Ribchester, the Roman Rigodunum, situated about 11 miles further up the river. Its name, originally Priest's town, it owed to the number of religious houses which it contained. Its history presents few events of interest. About 600 it was a Saxon settlement; in 1323 it was taken and burned down by Robert Bruce; in 930 its first parish church was

built; in the great civil war it espoused the Royalist cause, and suffered severely during the contest, having been twice captured by the Parliamentarians, who on the latter occasion were headed by Cromwell in person; in the rebellion of 1715 it was occupied by the Jacobite forces, who erected barricades and made a brave resistance, but were ultimately obliged to surrender at discretion; in that of 1745 the Highlanders, headed by the Pretender, passed through Preston both on their march to London and on their retreat. It became a borough by prescription, but obtained the confirmation or extension of its privileges by no fewer than fourteen royal charters—the first from Henry II., and the last from Charles II. It returns two members to Parliament, and is governed by a mayor, eleven other aldermen, and 36 councillors. Pop. in 1881, mun. bor., 96,537; parl. bor., 100,262; in 1891, county bor., 107,573; parl. bor., 111,685; in 1901, 112,982 and 118,220.

PRESTONPANS, a small town in Scotland, in the county of Haddington, on the Firth of Forth, 9 miles east of Edinburgh. It consists chiefly of one long street, and has a harbour known as Morison Haven. The buildings include an Established and a United Free church, and an educational institution called Schaw's Hospital. The principal public works are those of the Summerlee and Mossend Iron and Steel Co., a pottery, soap-works, salt-works, and a brewery. In the immediate vicinity was fought (21st Sept. 1745) the famous battle in which the Highlanders, headed by Prince Charles, signally defeated the royal troops commanded by Sir John Cope. Pop. (1891), 2224; (1901), 1721.

PRESUMPTION, in law, is a supposition held as good or real before it is shown or certainly known to be so. Presumptions are either *juris*, or *juris et de jure*. The *presumptio juris* is a presumption established in law till the contrary be proved. Thus, a person who has the possession of goods is presumed to be the owner, or a man is assumed to be innocent unless the contrary be proved. The *presumptio juris et de jure* is that where law or custom establishes the truth of any point on a presumption that cannot be overcome by contrary evidence, as the presumption of incapacity in a minor with guardians to act without their consent. Presumptions are adopted from the necessity of arriving at some conclusion or other in most cases where the evidence is general or inconclusive. Thus, where a person has disappeared and has not been heard of, the law will in general presume that he is still alive, unless after a lapse of time considerably exceeding the ordinary duration of human life; but if there be evidence of his continuous unexplained absence from home, and of the non-receipt of intelligence concerning him for a period of seven years, the presumption of life ceases.

PRETENDER. See CHARLES EDWARD STUART, and STUART (JAMES EDWARD FRANCIS).

PRETORIA, a town of South Africa, capital of the Transvaal, situated a short distance north of the small river Apies, a tributary of the Crocodile, at an elevation of about 4500 feet above sea-level, 32 miles north by east of Johannesburg, 349 miles (by rail) west of Delagoa Bay, and 1010 miles (by rail) north-east of Cape Town. The river Apies is here crossed by two bridges. The town is regularly laid out on the chess-board plan, and many of the streets have been planted with splendid willow-trees. The most important public buildings are: the government buildings, in Church Square, one of the finest piles in South Africa, erected at a cost of £200,000, surmounted by a statue of Liberty; the post-office; the Dutch Reformed Church, which will probably be removed from its present position in the centre of

Church Square; the Anglican cathedral of St. Alban, still uncompleted; a Roman Catholic church, with school and convent buildings; the Doppe, Wesleyan, Baptist, Kaffir, German, and other churches; the Jewish Synagogue, a handsome building; the new market buildings; a palace of justice, in course of erection for the reception of the law courts; a public library, containing both English and Dutch books; a museum, opened in 1894; a gymnasium and training institute; a public hospital, situated outside the town; several splendid bank buildings; the Pretoria Club building; numerous hotels; and several public halls; a public cricket-ground, a race-course, a public park and promenade, &c. The town is lighted by electricity, and public water-works were opened in 1891. Just outside the town are the barracks formerly occupied by the Transvaal State Artillery, and near them the prison is situated. In 1896 the Boer authorities began the construction of a circle of six forts round the town. Pretoria is an important railway junction, and is in railway communication with Cape Town and the other chief places in Cape Colony, Bloemfontein, Durban, Lourenço Marquez, &c. It was founded in 1855, and was named in honour of Andries Pretorius, the first president of the South African Republic. In 1863 it replaced Potchefstroom as the seat of the central administration. In December, 1880, the British garrison in Pretoria was besieged by a force of Boers, and on the retrocession of the country in the following year the town was evacuated by the British troops. The gold rush which began about 1886, and the working of the natural wealth of the neighbouring Witwatersrand, had a great influence upon the condition of Pretoria, which was rapidly improved in respect of architecture and sanitation. On June 5, 1900, the town was occupied, practically without opposition, by a British force under Lord Roberts, and then became the head-quarters of the British operations in the Boer War. The population before the war was about 12,000.

PREVEŖA, a fortified town of European Turkey, in the vilayet of Janina, on the northern side of the Gulf of Arta, 18 miles south-west from Arta. Near the town are found the ruins of Actium and Nicopolis. It belonged to Venice from 1683 till 1797, when it was ceded to France. In 1798 Ali, pasha of Janina, took it by storm, pillaged it, and put to death most of the male population. Since that date it has belonged to Turkey. Pop. about 7000.

PRÉVOST, ANTOINE FRANÇOIS, L'ABBÉ, usually called *Prévost d'Exiles*, a celebrated French novelist of the eighteenth century, was born at Hesdin, in the present department of Pas-de-Calais, on April 1, 1697. He was the son of a public official, and received his earlier education in the Jesuit college of his native town. In 1713-15 he passed his novitiate and continued his studies with the Jesuit fathers at Paris, and during the following year he studied philosophy in the college of that order at La Flèche. Leaving the order, he joined the army in 1717, and after a brief return owing to disappointed expectations, he again enlisted. About 1719 he once more gave up the military life and joined the Benedictines of St. Maur. For some seven or eight years he devoted himself earnestly to preaching and the observance of the duties of his order, but about 1727 some disagreement or technical misdemeanour caused him to flee to England, where he was for a time a tutor in a wealthy family. In 1729 he took up his residence in Holland, where he engaged in business as a bookseller. He appears at this time to have been concerned in various scandalous intrigues, and in 1731 he had to flee to England to avoid the consequences of some dishonest

acts. In the latter country he started a journal on the lines of the *Spectator*, entitled *Le Pour et Contre*, in which he sought to familiarize his countrymen with English manners and customs. In 1734 he returned to France and became almoner to the Prince de Conti, but seven years later he had again to leave his native country. His exile was passed in Brussels and Frankfurt, but from 1742, when he was permitted to return, he lived in France without interruption till his death. In 1754 he obtained the priory of Saint-Georges-de-Gesse, and on Nov. 23 or 25, 1763, he died suddenly of apoplexy near Chantilly. Prévost was a prolific author, but many of his works are merely compilations. He was familiar with English literature, and introduced Richardson, Dryden, and other great English authors to his countryman by means of translations. His masterpiece is the *Histoire du Chevalier Desgrieux et de Manon Lescaut*, which ranks as one of the greatest novels of its century. It originally formed the seventh volume of a series entitled *Mémoires et Aventures d'un Homme de Qualité qui s'est retiré du Monde* (eight vols. 1728-56), and was first published at The Hague in 1731. The relations of Desgrieux with Manon appear to be based upon some actual events of his life in Holland, and indeed the whole of the *Mémoires* are in large part autobiographical. The work has been censured for idealizing vice, and it cannot be altogether defended from this charge; but its easy, natural style, its unflinching charm, and its thoroughly realistic portraiture of persons who, though of a low type, are yet living and far from repulsive human beings, fully justify its great fame and popularity. His other works include: *Histoire de M. Cleveland, fils naturel de Cromwell* (1732); *Le Doyen de Killerine* (1735); *Histoire d'une Grecque Moderne* (1741); *Histoire de Marguerite d'Anjou* (1741); *Mémoire d'un Honnête Homme* (1745); *Mémoires pour servir à l'Histoire de la Vertu* (1762); *Contes, Aventures et Faits Singuliers* (1764). See works on Prévost in French by Harriague (1896) and Schroeder (1898).

PRÉVOST-PARADOL, LUCIEN ANATOLE, a French writer and member of the Académie, was born at Paris, August 8, 1829. He was educated at the Collège Bourbon and the École Normale. On leaving the latter in 1851 he devoted himself to literary pursuits, and the same year his *Éloge* on Bernardin de St. Pierre gained the prize for eloquence given by the French Academy. In 1855 he obtained the chair of French literature in the faculty of Aix, but soon resigned, and next year became one of the editors of the *Journal des Débats*. He maintained his connection with this paper to the last, and contributed to it a large number of articles distinguished by vigour, beauty of style, biting irony, and keen satire. As a lover of constitutional government the empire came frequently under the lash of his pen, and it was articles contributed by him to the *Courrier du Dimanche* that caused the suppression of that paper in 1866. On the accession of the Ollivier ministry in 1870 he accepted office under the imperial government, and went as ambassador to the United States; but soon after his arrival put an end to his own life—his mind being, it is believed, unhinged by the news of the declaration of war by France against Prussia, and by his cold reception by the Americans, whom he unexpectedly found were more German than French in their sympathies. He wrote *Études sur les Moralistes Français*, *Essai de l'Hist. Universelle*, *La France Nouvelle*, *Du Rôle de la Famille dans l'Éducation*, &c.

PRÉVOST'S THEORY. See HEAT EXCHANGES.

PRIAM, the king of Troy, famous in Greek poetry and legend, was the son of Laomedon and

Strymo or Placia, and called, in his earlier years, *Podarces* (Swift-foot); but when Hercules took Troy, and permitted Hesione to ransom one of the prisoners at her own price, she selected her brother Podarces. On this account he was ever after called *Priam* (the Ransomed). When a youth he marched with the Phrygians against the Amazons, and went as ambassador to the Thracians. After the death of his father he reigned in Troy. By his first wife, Arisbe, daughter of Merops, he had *Æscacus*. He afterwards gave Arisbe to Hyrtæus, and married Hecuba, by whom he had, according to Homer, nineteen children, among whom Hector, Paris, Creusa, Laodice, Polyxena, Cassandra, Deiphobus, Helenus, Pammon, Polites, Antiphus, Hipponous, Polydorus, and Troilus were the most distinguished. By four concubines he also had thirty sons and four daughters. His name has been rendered famous by the tragical fate of himself and his family, brought on by his blind love for his son Paris; for when he was extremely old the Greeks demanded of him the restoration of Helen, who had been carried away by Paris, and on his refusal to give her up they made war against Troy, took and destroyed the city after a siege of ten years, his son Hector having already fallen before his eyes. When the Greeks entered the city the old man armed himself, to seek death in the midst of the enemy; but the prayers of Hecuba prevailed upon him to take shelter at the altar of Zeus. Here he saw his son Polites fall by the hand of Pyrrhus; and, unable to contain himself, he hurled his javelin at the youthful warrior, who dragged the old man by the hair to the altar and plunged a sword into his breast.

PRIAPUS, in ancient mythology, originally a god of the fields in Lampascus, a town of Mysia, situated in a rich wine country. Aphroditê bore him to Dionysus when the latter was returning from India, but was unwilling to acknowledge him on account of his deformity. Others give him a different origin; but he was always god of the fields, the protector of gardens, bees, goats, and sheep. The earlier Greek poets, such as Homer and Hesiod, do not mention this divinity, and it was only in later times that he was honoured with divine worship. He was represented with horns and goat's ears, and large sexual parts, having in his lap all kinds of fruits; in his hand he held a sickle, and usually a horn of plenty. His worship spread from Lampascus over Greece to Rome. He is considered by mythologists to represent the productive power of nature.

PRICE. See VALUE.

PRICE, RICHARD, a distinguished mathematician and statistical writer. He was born at Tynton, in Glamorganshire, in 1723, and was educated at several different schools. On the death of his father, an intolerant Dissenting divine, who strongly disliked his son's liberality of sentiment, Richard found himself so poorly provided for that, wishing to complete his education in London, he was compelled to do most of the journey on foot. He obtained admission to a Presbyterian academy or college in London, and after four years' study engaged himself as chaplain to a Mr. Streetfield, with whom he lived thirteen years, and who on his death left him some property. By the death of an uncle in 1757 his circumstances were further improved, and he was enabled to carry out a matrimonial engagement he had formed with a Miss Blundell. He then became pastor of a Non-conformist congregation, of Arian or semi-Arian principles, at Hackney, where he continued as long as he lived. He commenced his literary career in 1758 by his *Review of the principal Difficulties in Morals* (8vo), which was followed by *Four Dissertations on the Importance of Christianity, the Nature of Historical Evidence, and Miracles*, &c. (1767, 8vo).

In 1769 he received the diploma of D.D. from the University of Glasgow. In 1771 appeared his *Observations on Reversionary Payments and Annuities* (8vo), which established his character as a mathematical calculator. This was followed by his compilation and publication of the celebrated Northampton Mortality Tables, and other valuable works relating to life assurance and annuities. He next published an Appeal to the Public on the Subject of the National Debt; and during the contest with the North American colonies advocated their cause in *Observations on Civil Liberty* (1776, 8vo), *Additional Observations*, and a Supplement. These tracts provoked the animadversions of a number of writers on the opposite side of the question, and exposed him to some obloquy, but they also procured him a vote of thanks from the corporation of London presented in a gold box. He engaged in an epistolary correspondence with his friend Dr. Joseph Priestley, on the subjects of materialism and necessity, the substance of which was laid before the public in an octavo volume in 1778. When Pitt became prime-minister he consulted Dr. Price in his schemes for the reduction of the national debt, and the establishment of the sinking fund was the result of his recommendation. At the commencement of the French revolution, in a sermon (published in 1789) *On the Love of Country*, he warmly expressed his delight at the emancipation of the French people. This discourse produced Burke's *Reflections*, in which Dr. Price was severely treated. He died April 19, 1791. Besides many papers in the *Transactions of the Royal Society*, of which he was a fellow, he published *Sermons on the Christian doctrine*, as received by the different Denominations of Christians (8vo), and several single sermons and political pamphlets.

PRICHARD, JAMES COWLES, a distinguished ethnologist, was born at Ross, in Herefordshire, in 1785, or a year later according to other authorities, studied medicine, and took the degree of M.D. at Edinburgh. On this occasion he chose for his thesis the physical history of mankind, a subject which he afterwards made his peculiar study. He commenced practice as a medical man at Bristol in 1810, and in 1814 received the appointment of physician to the Bristol infirmary. In 1813 he published his great work, *Researches into the Physical History of Mankind*, which, originally issued in one volume, was in the third edition, completed in 1819, extended to five. In 1831 he published an able work, *The Eastern Origin of the Celtic Nations*. In 1843 appeared his *Natural History of Man*, which has been translated into both French and German. He also produced several minor works on the subject of ethnology, besides numerous papers contributed to the British Association and other learned societies. In his own profession the diseases of the nervous system and the various phases of insanity engaged a large share of his attention, and he published treatises on the diseases of the Nervous System; on Insanity; and on the Different Forms of Insanity in relation to Jurisprudence. In 1845 he was appointed one of the commissioners of lunacy, and in consequence removed from Bristol to London, where he continued to reside to the close of his life. He died on 24d December, 1848.

PRICKLY PEAR, *Opuntia vulgaris*, natural order Cactaceae, the Indian fig. The *Opuntia* is a fleshy and succulent plant, destitute of leaves, covered with *fasciculi* of stellate spines, and consisting of flattened joints inserted upon each other. The flowers are pretty large, yellow, having numerous petals and stamens. They are succeeded by a purplish and edible pyriform fruit, which is sometimes imported into the British market. It is a native of the tropical

parts of America, whence it has been introduced into Europe, Mauritius, Arabia, Syria, and China.

PRIDEAUX, HUMPHREY, a learned English divine, born at Padstow, in Cornwall, in 1648, was educated at Oxford, and while at the university published the ancient inscriptions from the Arundel marbles, under the title of *Marmora Oxoniensis*. Lord-chancellor Finch, earl of Nottingham, gave him a prebend in Norwich cathedral, and Lord North bestowed on him the rectory of Bladon, which, on taking the degree of D.D., he exchanged for that of Saham Toney, in Norfolk. He was subsequently promoted to the archdeaconry of Suffolk, and in 1702 made Dean of Norwich. His death took place November 1, 1724. Besides his great work, entitled the *Old and New Testament connected in the History of the Jews and neighbouring Nations*, of which there are many editions, he was the author of the *Life of Mohammed* (8vo), the *Original and Right of Tithes* (8vo), *Ecclesiastical Tracts* (8vo), &c.

PRIEGO, a town in Spain, Andalusia, in a beautiful plain watered by the Salado, 36 miles south-east of Cordova. It is well built, and has an ancient castle, built by the Romans, and enlarged by the Moors; an old Gothic church, three suppressed convents, a nunnery, and a foundling hospital. Priego was once famous for its silk manufactures, now reduced to insignificance. Miguel Lopez, the sculptor, was born here. Pop. (1887), 15,765.

PRIEST (Hebrew, *kôhen*; Greek, *hiercus*; Latin, *sacerdos*). The English word *priest*, like the German *priester* and the French *prêtre*, is simply a contracted form of the word *presbyter*. (See PRESBYTERIANISM.) In its most general signification the title was applied to those officers who were called by choice or birth to inculcate and expound religious dogmas, to perform religious rites, and to fulfil in other ways the functions of a mediator between the worshippers and the Being worshipped. Among the ancient pagan nations all that was dignified and venerable, that deserved respect and obedience, that stood nearer to the Divinity than the common mass of mortals, was associated with the idea of the priestly office. The patriarch of the primitive world was at once the king and the priest of his family; and when the state was developed from the family the royal and priestly dignity still continued for a long time to be united in the same person. But these offices became separated in those states of antiquity which owed their existence to the ascendancy of single heroes or conquering tribes; and by the side of the regal dignity and sovereignty a sacerdotal order, which in some countries was elective, in others hereditary, grew up, and by the reputation of superior wisdom and secret communion with the gods (whence the priests were also honoured as magicians and physicians), inspired the mind with awe. In the states of Western Asia, in Egypt, Greece, and Rome, the priests were therefore public councillors and instruments of government. Their original office was to bring down divine things to the conception of men, and to solemnize the public worship of the gods by sacrifices, prayers, and religious pomp (mysteries). Instruction and the interpretation of symbolical doctrines ceased to be a part of their office when the mythical religious system came to an end; and when the poets, rhetoricians, and philosophers assumed the office of interpreters of the myths, the sole business of the priests became the performance of the religious rites. In sacred history the patriarchal order furnishes an example of the family priesthood. Abraham, Isaac, and Jacob perform priestly acts, and 'draw near to the Lord' (Gen. xii. 8; xviii. 23; xvi. 25; xxxiii. 20), as also does Job (i. 5). Instances of the union of the priestly and princely dignity are found in Melchisedek and

Jethro; the Arab sheikh to this hour unites in his person the civil and religious headship.

The Mosaic priesthood was the inheritance of the sons of Aaron, of the tribe of Levi. The order of the priests stood between the high-priest on the one hand and the Levites on the other. (See HIGH-PRIEST and LEVITES.) The ceremony of their consecration is described in Exodus xxiv. and Leviticus viii. The dress they wore during their ministrations consisted of linen drawers, with a close-fitting cassock also of linen, white, but with a raised diamond or chess-board pattern on it. The cassock, which descended nearly to the feet, was gathered round the body with a girdle of needle-work, into which blue, purple, and scarlet were intermingled with white, and worked in the form of flowers. On their heads they wore caps also of fine linen, and in the form of a cup-shaped flower. In all their ministrations the priests were barefooted, from the acknowledged impropriety of entering sacred places with shoes on the feet—a custom which prevails in the East at the present day. Before they entered the tabernacle they washed their hands and feet, and during the time of their ministration they partook of no wine or strong drink. They were not to mourn for the dead except in the case of a father, mother, son, daughter, brother, or sister (if a virgin). They were forbidden to marry an unchaste or foreign woman, one who had been divorced, or the widow of any but a priest. Their chief duties were to watch over the fire on the altar of burnt-offerings, and to keep it burning continually both by day and night after it had been first kindled from heaven. They fed the golden lamp outside the veil with oil. They had to offer a lamb morning and evening, and two lambs on the Sabbath, each accompanied with a meat-offering and a drink-offering at the door of the tabernacle. These were fixed duties which never varied, but their chief function was their being always at their post to do the priest's office for any guilty, penitent, rejoicing, or thankful Israelite. The worshipper might come at any hour. As the people started on each day's march, during the wanderings of the Israelites, the priests sounded an alarm with long silver trumpets. They blessed the people at every solemn meeting and at every regular daily sacrifice. They had, further, the task of instructing the people in the law of God, and were the guardians thereof. They blessed the army before the beginning of an action, and some of them seem to have taken part in the fighting. Functions such as these necessarily took up the greater part of their time, and accordingly a distinct provision had to be made for them. This consisted of one-tenth of the tithes which the people paid to the Levites, or 1 per cent. of the whole produce of the country; of a special tithe every third year; of the redemption-money, paid at the fixed rate of 5 shekels a head for the first-born of man or beast; of the redemption-money in like manner paid for men or things specially dedicated to the Lord; of spoil, cattle, captives, &c., taken in war; of the show-bread, the flesh of the burnt-offerings, peace-offerings, trespass offerings, and in particular the heave-shoulder and the wave-breast; of an undefined amount of the first-fruits of corn, wine, and oil. On their settlement in Canaan the priestly order had thirteen cities allotted to them, with pastures for their flocks. These provisions were obviously intended to secure the religion of the Israelites from the dangers of a caste of pauper priests, needy and dependent; but the priests were, on the other hand, as far as possible removed from the condition of a wealthy order. The earliest historical trace of any division of the priesthood, and corresponding cycle of services, belongs to the time of David. The order was then divided into twenty-

four courses, each of which was to serve in rotation for one week, while the further assignment of special services during the week was determined by lot. To the descendants of Ithamar, son of Aaron, eight courses only were assigned, but to those of his brother Eleazar sixteen were allotted. The division thus instituted was confirmed by Solomon, and continued to be recognized as the typical number of the priesthood. On the return from the captivity there were found but four courses out of the twenty-four, each containing in round numbers about 1000. Out of these the twenty-four courses were reconstituted, bearing the same names as before, and so continued till the destruction of Jerusalem.

In the New Testament the name given to the ministers of the Christian religion is *presbyteros* (elders), and the writers do not employ the Greek term *hiericus* (from *hieros*, sacred) except when they speak of the Jewish or other priests; but the latter, as well as the corresponding Latin word *sacerdos*, came into general use in the sense of priest at an early date. It is held by many Protestants that the idea of a consecrated priesthood invested with sacerdotal functions is repugnant to Christianity. Those Christians, however, like the Roman Catholics, Greeks, &c., who look upon the eucharist as a sacrifice, have a system of priesthood. The priest is the ordinary minister of the eucharist, of baptism, penance, and extreme unction; and by the Roman Church he is regarded as the official witness of the celebration of marriage, the contracting parties being considered by modern divines to be themselves its ministers. To him is officially intrusted the instruction of the people and the direction of their spiritual affairs. The order of priesthood is conferred by a bishop, ordinarily assisted by two or more priests, all of whom impose hands on the candidate for holy orders. The priests of the Church of Rome are bound to a life of celibacy. In the Greek Church the priesthood may be conferred on married men, but no one is allowed to marry after ordination, or marry a second time should his first wife die. In the Anglican as well as other reformed Episcopal churches the term priest is used to designate the second order of clergy, bishops ranking first. It is the duty of the priest to celebrate the sacrament of the Lord's supper; to pronounce the forms of absolution in the morning and evening prayer, in the communion service, and in the office for the visitation of the sick; and to preach, which office is, however, extended occasionally by special license to deacons.

As it is considered by many that the Jewish priesthood was modelled in some measure upon that of Egypt, it may be serviceable to note several facts connected with the latter. The sacerdotal order in Egypt constituted the highest of the four principal castes into which the kingdom was divided. The priests were the principal confidential and responsible advisers of the king; they assisted him in the performance of his public duties, and explained to him from the sacred books those lessons which were laid down for his conduct. They were endowed with lands by the kings, and seem to have had a public maintenance besides. Each deity had several priests and a high-priest; the minor priests were divided into various grades having distinct offices, as well as the scribes and priests of the kings. The same office descended from father to son, but was sometimes changed. They enjoyed important privileges, which were extended to their whole family. They were exempt from taxes. Wine was allowed to them in strict moderation, and, as well as animal food of all kinds, was abstained from during their numerous and protracted fasts. Each grade of the priests was distinguished by its peculiar costume. The high-

priests, who, among other official duties, anointed the king, wore a mantle made of an entire leopard-skin, as did the monarch when engaged in priestly duties. The under-dresses of priests of all orders were made of linen, and they were not allowed to wear woollen in a temple. Besides their religious functions, the priests fulfilled the offices of judges and legislators, and the laws forming part of their sacred books could only be administered by members of that order. See BRAHMAN, DRUID, MAGI.

PRIESTLEY, JOSEPH, an eminent philosopher and divine, was born 13th March, 1733 (o.s.), at Fieldhead, near Leeds. His father was a clothier, of the Calvinistic persuasion, in which he was also himself brought up under the protection of an aunt, who, after he had attained a respectable degree of classical acquirement in several schools of the neighbourhood, finally placed him at the Dissenting academy at Daventry, with a view to the ministry. He spent three years at this school, when he became acquainted with the writings of Dr. Hartley, which made a great impression upon his mind; and he was gradually led into a partiality for Arianism. On quitting the academy in 1755 he accepted an invitation to become minister of Needham Market, in Suffolk, where he had to live as best he could on an average salary of £30 a year. After a residence of three years he undertook the charge of a congregation at Nantwich, in Cheshire, to which he joined a school. Here his reputation increased, and in 1761 he was invited by the trustees of the Dissenting academy at Warrington to occupy the post of tutor of languages and belles letters under Dr. Aikin. At Warrington his political opinions were manifested in an Essay on Government. He published an Essay on a Course of Liberal Education, and his useful Chart of Biography. He also prepared some school-books, and even wrote some poetry. Here he married a Miss Wilkinson, a lady of great talent and amiability. A visit to London having introduced him to Drs. Franklin, Watson, and Price, he was encouraged to compose a History of Electricity, which first appeared in 1767, and procured him an admission into the Royal Society; he had previously obtained the title of Doctor of Laws from the University of Edinburgh. In the same year he accepted an invitation to become minister, at a salary of £100 a year, of the Mill Hill chapel at Leeds, where his religious opinions became decidedly Socinian. At Leeds, owing to his dwelling being near a brewery, his attention was first drawn to the properties of 'fixed air' (carbonic acid gas); and about this time he completed his History and Present State of Discoveries relating to Vision, Light, and Colours. In 1771 he agreed to accompany Captain Cook on his second voyage in the capacity of astronomer, but he had the deep mortification of having his appointment cancelled, as the Board of Longitude objected to his theology. After a residence of six years at Leeds he accepted an invitation from the Earl of Shelburne, afterwards Marquis of Lansdowne, to reside with him as a companion in the nominal capacity of librarian, with a salary of £250. While forming a part of the establishment of this nobleman, he occupied himself in scientific pursuits, and in 1773 gave to the Philosophical Transactions a paper on the different kinds of air, which obtained the prize of Copley's gold medal. In 1774 he discovered oxygen or 'dephlogisticated air,' as he called it, a result which was quickly followed by other important discoveries, such as nitrous gas, nitrous oxide gas, sulphurous oxide gas, fluoric acid gas, muriatic gas, ammoniacal gas, &c., as well as the pneumatic apparatus now in common use. By these exploits he may be said to have been almost the first to render chemistry a precise science. He

travelled through France, Holland, Belgium, and Germany, and made many new friends. The Parisian chemists and mathematicians told him he was the only philosopher of standing known to them who believed in Christianity. In 1775 he published his Examination of the Doctrine of Common Sense, as held by Drs. Reid, Beattie, and Oswald, and soon after published the treatise of Hartley. He had already declared himself a believer in the doctrine of philosophical necessity, and in a dissertation annexed to his edition of Hartley expressed some doubts of the immateriality of the sentient principle in man. This doctrine he still more forcibly supported in his Disquisitions on Matter and Spirit (1777); and the obloquy which these works brought on him producing a coolness in his patron, the connection was dissolved in 1780, the doctor retaining an annuity of £150 per annum by original agreement. He next removed to Birmingham, where he became once more minister of a Dissenting congregation, and occupied himself on his History of the Corruptions of Christianity, and History of the Early Opinions concerning Jesus Christ. In connection with Dr. Darwin, Messrs. Watt, Boulton, Wedgwood, and other famous men he founded the now celebrated Lunar Society, which rendered Birmingham for the time of its existence almost the intellectual centre of England. His Familiar Letter to the Inhabitants of Birmingham was written in support of the claims of the Dissenters for a repeal of the test acts. The era of the French revolution added to the usual animosity of theological dispute. The anniversary of the capture of the Bastille being celebrated at Birmingham, a mob assembled, and although Dr. Priestley was not present, proceeded to his house, which, with his library, manuscripts, and apparatus, fell a prey to the flames. The outrage was countenanced by too many exercising both lay and clerical influence, and the legal compensation which he obtained fell short of his real losses by about £2000, according to his own estimate. On 1st August, 1874, Birmingham made some amends for the wrong done to her greatest citizen, by the erection of a marble statue of him in front of the town-hall. On quitting Birmingham (1791) he was chosen to succeed his friend Dr. Price as preacher in the Gravel Pit Chapel, Hackney, where he remained some time in the cultivation of his scientific pursuits, until finally goaded by party enmity to seek an asylum in the United States, which he reached in 1794, and took up his residence at Northumberland, in Pennsylvania. In America he dedicated his whole time to his accustomed pursuits, until a severe illness laid the foundation of a debility in his digestive organs; and a gradual decay followed, which terminated his existence, February 6, 1804, in his seventy-first year. He had composed not long before his Jesus and Socrates Compared. Dr. Priestley was an ardent controversialist, chiefly in consequence of extreme simplicity and openness of character; but no man felt less animosity towards his opponents than he did, and many who entertained the strongest antipathy to his opinions were converted into friends by his gentleness and urbanity in personal intercourse. As a man of science he stands high in the walk of invention and discovery, and to few has pneumatic chemistry been so much indebted. On his own admission his researches in his favourite science were superficial, and his great discoveries to a considerable extent accidental. Had he limited his field of study to a tenth of its actual dimensions, and devoted all his energies to the exploration of that smaller area, his work would probably have still seemed faulty in many ways to the exact critics of our age. Distributing his powers so widely as he did the faults were necessarily numerous. But this

should detract nothing from the honour due to the earnest pioneer. As a metaphysician his elucidation of Hartley's theory of association, his works upon philosophical necessity and upon materialism, will always insure attention. As a theologian Dr. Priestley, who followed his convictions wherever they led him, passed through all changes, from Calvinism to a Unitarian system in some measure his own; but to the last remained a zealous opposer of infidelity. Of his theological and controversial productions, those most generally esteemed are his *Institutes of Natural and Revealed Religion*, and *Letters to a Philosophical Unbeliever*. He also wrote many works of practical divinity. There is an edition of his *Theological and Miscellaneous Works*, with *Memoirs and Correspondence* (26 vols. 1817-32).

PRILUKI, or **PRILOUKY**, a town of Russia, in the government of Poltava and 120 miles north-west of the city of that name, situated on the Udaia. It is a poorly-built and dirty town, but has three important annual fairs, and a considerable trade in corn, cattle, saltpetre, tobacco, and brandy. Pop. 15,231.

PRIM, **JUAN**, **MARQUIS DE LOS CASTILLEJOS**, **COUNT DE REUSS**, Field-marshal and Grandee of Spain, son of Pablo Prim, a colonel of infantry, was born at Reuss, in Catalonia, 6th December, 1814. He was destined for the law, but on the outbreak of the civil war which followed the death of Ferdinand VII. (29th September, 1833) he joined the volunteers who had taken up arms in the cause of the infant queen Isabella. In a short time his skill and valour obtained for him the command of a company, and in 1837 he was appointed a colonel in the regular army. When the civil war terminated in 1839 Prim turned his attention to politics, became an active deputy in several parliaments, and organized several political clubs. When Queen Maria Christina quitted Spain he allied himself with the *Progresista* party, and vigorously opposed Espartero, who had assumed the regency, 8th May, 1841. Taking part in the insurrection at Saragoza in 1842, but being unsuccessful, he was obliged to take refuge in France, where he attached himself to Queen Maria Christina. The amnesty of the following year permitted his return, and he was chosen deputy to the Cortes by Barcelona. In the May of that year he placed himself at the head of an insurrectionary movement against Espartero at Reuss, and on being dislodged from that town fled to Barcelona, where he succeeded in raising the inhabitants in his favour. On the downfall of the Espartero ministry Prim was appointed by the queen a brigadier-general. Shortly afterwards he was created Count de Reuss, and was intrusted with the governorship of Madrid (1843). On the occasion of a democratic rising at Barcelona he was sent to restore order, but with little success. The revolt soon began to attain wide proportions, and Prim was accused of dilatoriness and dismissed from his command. Irritated at this disgrace, he joined a conspiracy whose objects were the overthrow of the government and the assassination of Narvaez, president of the council. In November, 1844, he was brought to trial for his share in the baulked conspiracy, was convicted and sentenced to six years' seclusion in a fortress, a sentence which was revoked by the queen in January, 1845. For several years he lived a sort of retired life, but in 1853 he offered his services to the sultan, received a command, and contributed to the early successes of the Turks against the Russians on the Danube. On his return to Spain he found O'Donnell and the chiefs of the liberal union at the head of affairs, and eagerly leagued himself with them. In 1857 he was promoted to the rank of lieutenant-general, and in 1858 was raised to the senate. In the following year, war

having broken out between Spain and Morocco, Prim was appointed to the command of the reserve. His bravery and presence of mind at Castillejo on the New-Year's day of 1860 turned what might have been a total rout into a victory for Spain, and he was rewarded with the title of Marquis of Castillejos. The decisive defeat of the Moors at Guad-el-Ras on the 23d March led to a treaty of peace. About the end of 1861 he was appointed to command the Spanish contingent, which, along with others from England and France, was sent out to Mexico to enforce the claims of indemnity which the subjects of these states had against that country, but along with the English he withdrew his forces when it became apparent that the French were determined to found an empire there. In January, 1866, he headed a military uprising against the government of O'Donnell; but the insurrection was speedily suppressed, and he, with many of his followers, was compelled to take refuge in Portugal. Soon afterwards he came to London, where he lived for some time in comparative seclusion. The movement headed by Serrano and Topete to drive Queen Isabella from the throne had his energetic support. He returned to Spain, and materially contributed to the success of his party. On the dethronement of the queen in September, 1869, he was appointed minister of war, and exerted himself to find a suitable candidate for the Spanish crown. This was at last found in the person of Amadeo, duke of Aosta, second son of the King of Italy. On the evening of the 28th December, 1870, Marshal Prim was shot by assassins as he was proceeding in his carriage from the Cortes to the ministry of war; and on the 30th, the day when the young king landed at Carthage, the veteran soldier and statesman died of his wounds.

PRIMAGE is the allowance made by shippers to the master of a vessel, or more commonly to the owner or charterer, for the trouble of loading and unloading cargo. It is usually combined in the bill of lading with average (see **AVERAGE**), both being estimated at a certain rate per cent. on the amount of freight.

PRIMATE, in the early Christian Church the title assumed by the bishop of the capital of a province, and hence equivalent to metropolitan. In Africa the title belonged to the bishop who had been longest ordained. In other parts of Christendom an attempt was made to distinguish between primates and metropolitans as early as the ninth or tenth century, for one of the capitularies of the early French kings ordains that no metropolitan shall assume the title of primate unless he has a just claim to that honour; and in the eleventh century the popes expressly reserved the title only for the leading metropolitans in different countries, and endeavoured to subordinate the other metropolitans to them. The resistance to this arrangement was, however, so general and emphatic that the dignity of primate remained little more than a nominal one, entitling the holder of it merely to precedence on public occasions. In France the Archbishop of Lyons was appointed primate of the Gauls by Gregory VII. in 1079. In the German Empire the Archbishop of Salzburg was primate. In Hungary the Archbishop of Gran is primate; in Bohemia that of Prague; in Spain that of Toledo. In Poland the primate was an important political functionary. The office belonged of right to the Papal legate, who was president of the senate and censor of the king. He governed the state during an interregnum, had a court, guards, and a marshal of the palace, and in general enjoyed the highest privileges. In the Church of England both the archbishops still retain the title of primate, the Archbishop of Canterbury being dis-

tingulated as the primate of all England and the Archbishop of York as the primate of England. In the Protestant Episcopal Church of Ireland the Archbishop of Armagh is primate as formerly when the church was established.

PRIMATES, the name given by Linnæus to his highest order or group of the Mammalia, which included the Bats (*Cheiroptera*), the Quadrumana or Apes, Monkeys, Lemurs, and Man (*Bimana*). More recently the name Primates (as explained in the articles **LEMUR**, **MONKEY**, &c.) has been used to include the orders Bimana and Quadrumana only, thus placing Man, Monkeys, Apes, and Lemurs in one great division characterized by a certain amount of close structural resemblance. The Linnæan order Primates included mammals possessing nails or *unguiculate* forms, with 'front teeth (*cutters*), 4; caninaries, 1.'

PRIMATICCIO, FRANCESCO, a painter of the Bolognese school, born at Bologna in 1505, received his first instruction from Innocenzo da Imbola, and completed his studies under Giulio Romano. In connection with several of the pupils of the latter he painted the Palazzo del Te, in Mantua, from Giulio's designs. Through the recommendation of Frederick, duke of Mantua, Primaticcio was taken into the service of Francis I. of France in 1531. His arrival and residence in France makes an epoch in French art. To his influence were owing not only numerous paintings in fresco and works in stucco which the king caused to be executed, but several branches of painting, as, for instance, enamel painting, and designs for tapestry, were carried to great perfection through his exertions. Francis sent him to Italy to purchase antique statues, of which he made a respectable collection, and caused numerous casts to be executed. On the death of Rosso, the royal painter, Primaticcio succeeded him in his post, and Francis II. appointed him in 1559 superintendent of the royal buildings. He furnished the designs of several architectural works, among them of the tombs of Francis I. and Henry II. His works at Fontainebleau, however, gained him more reputation. He was assisted in his labours by several of his countrymen, of whom Niccolo del Abbate was the most distinguished. Primaticcio died in 1570. The works which he executed in France are nobler and freer, in point of design, than those which he executed in Giulio's school. In his great works he often violated nature.

PRIME, in the Roman Catholic Church one of the canonical hours, the first of those belonging to the day as opposed to those of the night, and also the service in the breviary which falls to be performed at that time. The name of prime is derived from the Latin *prima* (that is, *prima hora*, first hour), because prime begins with sunrise, or rather the first hour of the day according to the eastern mode of reckoning, namely, 6 o'clock. The service of prime is by some said to be in commemoration of our Lord's appearance before Pontius Pilate, and by others of his resurrection. In the ritual of the English Church some portions of the service of prime are incorporated with that of matins.

PRIME CONDUCTOR, that part of an electric machine from which sparks are usually taken. In the ordinary plate electric machine it is an insulated body, which gathers positive electricity from the rubbed glass plate by means of a row of points.

PRIME MINISTER, or **PREMIER**. See **MINISTER**.

PRIME NUMBER, a number which can be divided exactly by no number except itself and unity. See **NUMBERS** (THEORY OF).

PRIMING, the entrance of water spray along with steam into the cylinder of an engine. It always causes great annoyance. The use of muddy water,

insufficient steam-room, carelessly constructed flues and pipes, &c., in the boiler, give rise to priming. Superheating the steam is one remedy.

PRIMOGENITURE, the right of the eldest son and those who derive through him to succeed to the property of the ancestor. This right, though in a modified sense, seems anciently to have prevailed only among the Jews. The first-born in the patriarchal ages had a superiority over his brethren, and in the absence of the father was priest of the family. Among the Jews he had a double portion of the inheritance; in the same manner as by the laws of Henry I. in England the eldest son had the capital fee or principal feud of his father's possessions, and no other pre-eminence, and as the eldest daughter had the principal mansion when the estate descended in coparcenary. The 'insolent prerogative of primogeniture,' as Gibbon denominates it, was unknown among the Romans; the two sexes were placed on a just level; all the sons and all the daughters were entitled to an equal portion of the patrimonial estate. The Greeks, the Britons, the Saxons, the Danes, &c., divided the lands equally, some among all the children at large, some among the males only. The equal division of the patrimonial estate among the children is certainly the most obvious and natural way. When the emperors began to create honorary feuds or titles of nobility it was found necessary, in order to preserve their dignity, to make them impartible, and, in consequence, descendible to the eldest son alone. This example was further enforced by the inconveniences that attended the splitting of estates, namely, the division of the military services, the multitudes of infant tenants incapable of performing any duty, the consequent weakening of the strength of the kingdom, and the inducing younger sons to take up with the business and idleness of a country life instead of being serviceable to themselves and the public by engaging in mercantile, military, civil, or ecclesiastical employments. These reasons occasioned an almost total change in the nature of feudal inheritances; so that the eldest son began, universally, to succeed to the whole of the lands in all military tenures.

In this condition the feudal constitution was established in England by William the Conqueror. Before the conquest the descent of lands was to all the sons alike. Socage estates in England frequently descended to all the sons equally till the time of Henry III., when, in imitation of lands in chivalry, they had almost entirely fallen into the right of succession by primogeniture, except in Kent, where they gloried in the preservation of their ancient gavelkind tenure, of which a principal branch was the joint inheritance of all the sons, and except in some particular manors and townships, where their local customs continued the descent sometimes to all, sometimes to the youngest son only, or in other more singular methods of succession. The right of primogeniture, which calls the eldest born to the crown, was not introduced into France till very late; it was unknown to the first and second race of kings. The four sons of Clovis shared the kingdom equally among themselves. Those of Louis le Debonnaire did the same; and it was not till the race of Hugh Capet ascended the throne that the prerogative of succession to the crown was appropriated to the first-born. The right of primogeniture is now abolished in France and Belgium, but it prevails in some degree in most other nations of Europe. The rule operates as follows:—When a person dies intestate, leaving real estate, his eldest son is entitled by law to the whole; if the other brothers and sisters are not provided for out of the personality they are left destitute. If the eldest son is dead, but has left an eldest son, the latter succeeds to the whole of the property. If the whole male line is exhausted then

the daughters succeed—not in the same way, however, but jointly, except in the case of the crown, to which the eldest succeeds. In the United States no distinction of age or sex is made in the descent of estates to lineal descendants. See DESCENT, LAND (PROPERTY IN).

PRIMROSE (*Primula*; natural order Primulaceæ—see below), a genus of beautiful plants, some of which are among the earliest flowers in spring, as the common primrose (*P. vulgaris*), the oxlip (*P. elatior*), and cowslip (*P. veris*); and several are cultivated in gardens as ornamental plants. Their roots are perennial; the leaves almost always radical; and the flowers supported on a naked stem, and usually disposed in a sort of umbel. The calyx is tubular; the corolla funnel-shaped, and divided at the summit into five equal lobes; the stamens five in number; the style single; and the capsule oval, one-celled, and containing numerous seeds attached to a central placenta. The varieties of the common primrose which have arisen from cultivation are very numerous, and from the cowslip are derived the numerous kinds of Polyanthus (which see). The *P. auricula*, a native of the Alpine regions of Italy, Switzerland, and Germany, is also a well-known favourite with the florist; and the Chinese primrose (*P. Sinensis*) is a favourite greenhouse and window plant. The primrose exhibits the curious phenomenon of dimorphism as regards the length of the style in different blossoms, some being short-styled, others long-styled, a feature of importance in regard to fertilization. See CROSS-FERTILIZATION in SUPP.

PRIMULACEÆ, or PRIMROSES, a natural order of gamopetalous dicotyledons, consisting of herbaceous, sometimes almost shrubby plants, with usually radical, but sometimes whorled and opposite or alternate leaves; flowers on radical scapes and in umbels, or variously arranged in the axils of the leaves; regular persistent five-cleft calyx, inferior or half-superior; hypogynous, regular corolla, with stamens equal to the number of its segments inserted upon it; one style and capitate stigma; and a capsule opening with valves and containing numerous peltate seeds. Many cases of anomalous structure occur in the order. The species are common in the northern and colder parts of the globe, sometimes growing among the snows of lofty mountains. They are rare within the tropics, occurring only on the sea-shore or elevated heights. They possess few economic properties; but the early and modest appearance of the primrose and cowslip in our fields, and the gay appearance of others in our gardens, make them general favourites. Among British genera of this order are *Primula* (see PRIMROSE); *Anagallis*, including the Pimpernel (*A. arvensis*) and the Bog Pimpernel (*A. tenella*); *Lysimachia*, including the Moneywort (*L. nummularia*), the Wood and the Common Loosestrife (*L. nemorum* and *vulgaris*); &c.; *Cyclamen*, including the Sowbread (*C. europæum*); *Glaux*, comprising the Sea Milkwort (*G. maritima*); *Samolus*, with the Water Pimpernel (*S. vallerandi*); *Hottonia*, including the Water Violet (*H. palustris*); &c.

PRIMUM MOBILE, in the Ptolemaic astronomy, the ninth or highest sphere of the heavens, whose centre is that of the world, and in comparison with which the world is but a point. This the ancients supposed to contain all other spheres within it, and to give motion to them, turning itself, and all of them, quite round in twenty-four hours. See ASTRONOMY.

PRINCE (from Latin, *princeps*), literally one who holds the first place. In ancient Rome the title of *princeps senatus* was given to the leading senator, being the one whose name came first in the list

and who had the right to record his vote first. The title of *princeps juventutis* (chief of the youths) was one bestowed on Caius and Lucius Cæsar, grandsons of Augustus, and was then conferred on the probable successor to the imperial seat. In modern times the title of *prince* (or *princess*) is given to all sovereigns generally, as well as to their sons and daughters and their nearest relations. In England the title is also applied, in strict heraldic language, as a mode of address to dukes, marquises, and earls, but it is not generally so used. In Germany there is a class of sovereigns, ranking next below the dukes (*Herzog*), who bear the title of prince (*Fürst*) as a specific designation. The members of royal families are there called *Prinzen* instead of *Fürsten*, to distinguish them from the class to whom the latter title more peculiarly belongs. On the Continent there are ancient families not immediately connected with any reigning house who bear the title of prince. Formerly, in France, *duke* was a title superior to *prince*. In England the only case in which the title is a territorial one is that of the Prince of Wales.

PRINCE EDWARD ISLAND, a province in the Dominion of Canada, in the south of the Gulf of St. Lawrence, and east of Cape Breton; washed by the Gulf on the north, and separated by Northumberland Strait from New Brunswick on the east and Nova Scotia on the south; greatest length (on a curve), about 150 miles; breadth, varying from 4 to 34 miles; area, about 2133 square miles, or 1,365,760 acres, of which over 1,000,000 are under cultivation. The coast-line presents a remarkable succession of large bays and projecting headlands. Of the latter the most prominent are North Cape on the north-west, West Cape on the south-west, and East Cape on the north-east; the largest bays are those of Richmond on the north-west, Egmont and Bedeque on the south-west, Hillsborough on the south, and Cardigan on the east. The surface undulates gently, nowhere rising so high as to become mountainous, or sinking so low as to form a monotonous flat. At one time the whole island was densely covered with beech, maple, fir, and other trees, and it is still sufficiently well wooded. The island is eminently agricultural and pastoral. The soil consists generally of a light reddish loam, sometimes approaching to a strong clay, but more frequently of a light and sandy texture. The prevailing rock is a reddish sandstone. No minerals of the least consequence have yet been discovered. The climate is much milder than that of the adjoining continent, and the air, generally free from the fogs which spread along the shores of Cape Breton and Nova Scotia, is remarkably salubrious. During the greater part of July, August, and September the thermometer during the hotter hours of the day seldom varies more than from 75° to 80° Fahr. Agriculture is a thriving industry, and first-rate crops of wheat, barley, oats, beans and pease, potatoes, turnips, &c., are raised; excellent apples are also produced, a good stock of horses, cattle, sheep, and swine is kept. The fisheries along the coasts are very productive. The most valuable item in the catch is the lobster, followed by the mackerel, cod, herring, and hake. The manufactures are chiefly confined to linen and flannels for domestic use; there are also several tanneries, and some ship-building is carried on. The exports consist mostly of agricultural produce and live stock, and fish; the imports, of dry goods, hardware, iron, &c. The capital is Charlottetown, which has a population of 12,080, and has been connected with all the principal places in the island by railway. Other towns are Summerside, Georgetown, and Souris. There is a lieutenant-

governor nominated by the crown, who appoints an executive council of 8 members, with a legislative assembly of 30 members, half elected on a property qualification, and half on a popular franchise. Who discovered Prince Edward Island is not accurately known, but Cabot is supposed to have seen it immediately after he had discovered Newfoundland. Champlain gave it the name of St. John, by which it continued long to be designated, and accurately described both its situation and extent. It was afterwards included by the French in their vast and undefined territory of New France, and in 1663 was granted on a feudal tenure to a Sieur Doublet, a French naval officer. Little progress was made in settling the island till after the Peace of Utrecht in 1715, when its fertility allured great numbers of settlers from Cape Breton. It was taken by the British in 1745, restored by the Peace of Aix-la-Chapelle, retaken, and finally annexed to Britain in 1768. In 1873 it was admitted into the Dominion of Canada. Pop. (1891), 109,078; (1901), 103,259.

PRINCE OF WALES, the title of the heir-apparent of the British throne, first conferred by Edward I. on his son (afterwards Edward II.), at the time of his conquest of the Principality of Wales. According to the well-known tradition Edward I. promised to give the Welsh a prince born in their own land, and unable to speak a word of English. This promise was very satisfactory to those to whom it was made, but was one of those kept to the ear but broken to the sense, for Edward fulfilled it by appointing his infant son Edward, who was born in Wales, and could not speak a word of any language. But the truth appears to be that the title was not bestowed upon Edward of Caernarvon till 1300 or 1301, seventeen years after the conquest of Wales, and sixteen after the birth of Prince Edward. Edward III. was never Prince of Wales, but the title has been conferred on all the male heirs-apparent to the English (and afterwards the British) throne from Edward the Black Prince, son of Edward III. The heir-apparent is made Prince of Wales and Earl of Chester by special creation and investiture, or by proclamation, but as the king's eldest son is by inheritance Duke of Cornwall, without any new creation. The title of Duke of Cornwall was first conferred on Edward the Black Prince, as eldest son of the king, in 1337. As heir to the crown of Scotland the Prince of Wales bears the titles of Prince and High-steward of Scotland, Duke of Rothesay, Earl of Carrick, Baron of Renfrew, and Lord of the Isles, in virtue of an act of the Scottish Parliament of 1469. The title of Earl of Dublin was bestowed upon the present Prince of Wales on September 10, 1849, when it was also ordained that that dignity should belong to him and his heirs, kings of the United Kingdom of Great Britain and Ireland, for ever. A statute of the order of the Garter, dated 1805, declares that the Prince of Wales shall, as soon as he receives this title, become a knight of the Garter. The arms of the Prince of Wales are the royal arms, with the addition of a label of three points argent, and any other addition that may be adopted by the different holders of the title. Thus the present Prince of Wales bears *en surmont*, the escutcheon of the house of Saxony. The Prince of Wales has also a badge, consisting of a plume of three white ostrich feathers, with the motto *Ich dien* (I serve), said, but on questionable authority, to have been adopted by the Black Prince from a prince of Bohemia whom he slew at Crécy. Another account says that when Edward I., according to the tradition already mentioned, presented his infant son to the Welsh as their native prince, he used the words *Eich dyn* (This is your man), from which the present motto is corrupted. The consort of the

Prince of Wales is called Princess of Wales, but when the sovereign has no son this title is bestowed upon the eldest daughter. To compass or conspire the death of the Prince of Wales is as much high treason as to conspire the death of the king, as is also the violation of the chastity of his consort.

PRINCE OF WALES ISLAND. See **PENANG**.

PRINCE RUPERT'S DROPS, pieces of glass which have been cooled very suddenly from the melted state by having been dropped into water. If we imagine an egg lengthened in the direction of its axis so that it has no small rounded end, but a lengthy tail tapering gradually to a point, we shall have a magnified image of one of these drops. They are called *larmes batariques* (Dutch tears) by the French; we also call them Dutch tears sometimes. The outside of the drop of melted glass is instantaneously solidified by the water, while the inside cools gradually, so that the outside shell is acted upon by very great stresses due to contraction of the internal portions when cooling. In fact the drop is kept in a state of excessive strain by stresses in unstable equilibrium; and if this equilibrium is destroyed by scratching the surface with a diamond, or breaking off the tip of the tail, the strained particles are violently released, and the mass is instantly pulverized. Heat is produced during the pulverization of the drop. This explanation applies to the falling out of the bottom of the very thick flask of unannealed blown glass called the 'Bologna flask,' when its surface is scratched. We see, then, that glass articles—articles of any brittle material—ought to be cooled very slowly from the melted state. The process of slow cooling to which such articles are subjected is called annealing. To anneal glass it is placed in a large furnace which has nearly a red-heat at one end and a lower temperature than 100° C. at the other; after the glass has been passed very slowly from the heated to the cool end it is able to withstand sudden changes of temperature, &c., without fracture.

PRINCE'S METAL, or **PRINCE RUPERT'S METAL**, a mixture of copper and zinc in imitation of gold.

PRINCETON, a small town of the United States, in Mercer county, New Jersey, 40 miles north-east of Philadelphia, and near the New Jersey Railway and the Delaware and Raritan Canal. It is the seat of the Princeton College, one of the first literary institutions in the country, founded by the Presbyterians at Elizabethtown in 1746, and removed hither in 1757. The town contains several churches, a bank, and a celebrated theological seminary of the Presbyterian Church. A battle was fought here in 1777 between the Americans under Washington and the British under Colonel Mawhood, in which the latter were defeated. Pop. (1890), 4231.

PRINCIPAL, in criminal law, either the actual perpetrator of the crime, or one who is present, or in the immediate vicinity, aiding and abetting the perpetrators. See **ACCESSARY**.

PRINCIPAL, the name given to the heads of the Scottish universities, and of several colleges in the English universities. By the Act of Union in 1707 principals, as well as others bearing office in any of the four universities of Scotland, were required to subscribe to the Westminster Confession of Faith, but this enactment has since been repealed.

PRINCIPAL AND AGENT, a designation in law, under which are classed the various questions which occur between mercantile agents and their employers, as to the extent of their duties and responsibilities. See **AGENT**, **BROKER**, **FACTOR**.

PRINCIPATO-CITRA and **PRINCIPATO-ULTRA**, called also by the new designations of *Salerno* and *Ardellino* respectively, two provinces in the Kingdom of Italy. The former, immediately

south of the other, and bounded west and south by the Mediterranean, and east by Potenza, has an area of 2117 square miles, an irregular coast-line jutting out into several bold promontories, and inclosing the Bay of Salerno; an interior much broken by ramifications of the Apennines; a fine climate, a very fertile soil, magnificent forests, and valuable tunny and anchovy fisheries. Pop. in 1881, 544,621.—The latter, with an area of 1402 square miles, is mountainous, but has deep, fertile, and well-cultivated valleys, in which maize, olives, and wine are the chief crops. Pop. (1881), 393,228. The chief towns of Principato-Citra are Salerno, the capital (from which it has been re-named), Sarno, and P'agani; of Principato-Ultra, Avellino, the capital (from which it has been re-named), and Ariano.

PRINCIPLE OF THE CONSERVATION OF ENERGY, a general denial of the possible existence of a perpetual motion. When a body is in motion it has power to do work when being brought to rest; its energy is said to be 'kinetic.' The kinetic energy of a body, (1) due to its motion as represented by the motion of its centre of gravity, and (2) due to its motion of rotation about any axis, may be calculated—that is, we can calculate the amount of mechanical work which it has power to do, if we know the form and density of the body and its motions. But in determining its kinetic energy due to the molecular invisible motions which we know to exist, but which we are unable to measure as motions, we are forced to depend upon the determinations of experimental physicists. Thus heat is known to be a molecular kinetic energy, and Joule has determined how much mechanical work is equivalent to a certain quantity of heat; so that heat may be measured, just as if it were a visible kinetic energy, in units of work. The energy which a system of bodies possesses in virtue of its configuration is called its 'potential energy;' it is the amount of work which the system is capable of doing by changing its configuration. Thus when a stone is 6 feet above the surface of the earth it can do a certain measurable amount of work in falling, in virtue of the force of gravity; and this power to do work is less if the stone is at a less height. Gunpowder contains, in a dominant form, an immense store of energy—that is, it has power to do an immense amount of work. This energy is possessed by it in a small compass, in virtue of its chemical constitution. The driving-weight of a clock, when wound up, has potential energy in virtue of its position; when it has run down it can no longer drive the clock. If water has power to fall it has potential energy, and may, in falling to a lower level, drive mills or other machinery; the weight through which it may fall is technically called its 'head.' In an air-gun there is a store of potential energy in the form of compressed air; in a wound-up watch, in the form of a bent spring; in a charged Leyden-jar, in the form of a distribution of electricity; in a voltaic battery, in a chemical arrangement; in a labourer ready for work, in the form of a proper supply of food. To all these dormant energies the name potential energy is given. When the forces acting in a system of bodies are all known the potential energy of the system may be measured. But in determining the molecular potential energy of a body, whether existing in the forms of strain, magnetism, latent heat, or electricity, &c., we must depend upon the experimental determinations of equivalents given by physicists. If the stone referred to above were to fall freely towards the earth potential energy would be lost by it, but an equivalent amount of kinetic energy would be gained, and at every instant the sum of its kinetic and potential energies is the same. Thus when a projectile

is discharged vertically upwards it possesses no potential energy at the beginning, its energy is all kinetic—that is, due to its motion. But as it rises it loses kinetic and gains an equivalent amount of potential energy, and as it falls again it loses potential and gains an equivalent amount of kinetic energy, and the sum of the kinetic and potential energies is always the same so long as there is no friction. When a pendulum oscillates, the energy originally given to the bob, whether in the kinetic form by projecting it from its lowest position, or in the potential form by drawing it aside from the vertical and then letting it fall, is continually transformed and retransformed every quarter oscillation. We might repeat these observations for the oscillations of any elastic body, the balance-spring of a watch, a tuning-fork, &c., assuming that there is perfect elasticity, else we should have to take into account the heat due to molecular friction. So long as there is no friction or viscosity, so long as heat or electricity or some form of molecular energy is not supposed to be created, the fact just stated may be easily proved by dynamical principles, and indeed if we assume that in any material system not acted upon by external forces the force acting between any two points is in the line joining them, and depends only on their distance asunder, and not on their motions at the time, we have dynamical proof that the sum of the potential and kinetic energies of the system will always remain the same. This is the principle of conservation of energy, the most important principle of modern philosophy. Thomson and Tait state it as follows:—'If a system of bodies, given either at rest or in motion, be influenced by no forces from without, the sum of the kinetic energies of all its parts is augmented in any time by an amount equal to the whole work done in that time by the mutual forces, which we may imagine as acting between its points. When the lines in which these forces act remain all unchanged in length the forces do no work, and the sum of the kinetic energies remains constant. If, on the other hand, one of these lines varies in length during the motion, the mutual forces in it will do work, or will consume work, according as the distance varies with or against them.' We have very strong reasons for believing that energy must be either potential or kinetic, and that the above assumptions as to forces which are known to be true in the case of attraction of bodies at a distance are true generally; yet we can only say with regard to the following general statement of our principle that it has been proved by experiment to be true within the limits of observational errors in cases where energy takes the forms of heat, magnetism, electricity, &c., and that no known fact disagrees with it. 'The total energy of any body or system of bodies is a quantity which can neither be increased nor diminished by any mutual action of these bodies, though it may be transformed into any of the forms of which energy is susceptible.' Newton was not aware of heat being a form of energy, but on the supposition of no loss of mechanical energy by friction he, in a scholium to his third law of motion, enunciated our principle with great clearness. The leading dates in the history of the subject are given in the article **JOULE'S MECHANICAL EQUIVALENT OF HEAT**. In January, 1843, Joule showed that mechanical work can be converted into an equivalent of heat by first converting it into induction currents of electricity; so that current electricity is a form of energy subject to the principle of conservation. He was thus led to the establishment of the principle in chemical action. The experimental verification of the principle in its generality, and the earliest suggestions of many of its applications, belong to Joule. Joule's

work has been extended by Helmholtz, Mayer, Rankine, and Lord Kelvin. Helmholtz (1847) founds the science of thermodynamics on Newton's principle, and on what he assumes as axioms—(1) the perpetual motion is impossible, and (2) the assumptions regarding forces given above. One of these assumptions is enough, for the one follows from the other. But many logical objections might be made to either of these assumptions, and they only give way when opposed by the facts discovered by Joule. For instance, Weber's hypothesis of the mutual action of currents, which receives a great amount of authority from experiment, requires the admission of mutual forces between moving quantities of electricity which are not consistent with the second axiom, and from which, therefore, a perpetual motion might be obtained; but here Joule's facts determine the truth of the axiom, and hence Weber's results merely show that electricity does not consist of two sets of particles, vitreous and resinous, as he had assumed. The theory of energy contemplates its conservation, transformation, and dissipation. In the article PERPETUAL MOTION these principles have been enunciated. It follows from them that as energy is constantly in a state of transformation there is a constant degradation of energy to the final unavailable form of uniformly diffused heat; and that this will go on as long as the transformations occur, until the whole energy of the universe has taken this final form. The law of dissipation of energy, discovered by Lord Kelvin, seems to be the most complete and most general statement of the whole theory of energy. We conclude with some further illustrations of the principle of conservation. When in perihelion a planet's potential energy is least and its kinetic energy is greatest, but at every part of the orbit the sum of these energies is the same. In the case of a comet moving in a parabolic orbit the sum of the kinetic and potential energies at any time is equal to the potential energy at an infinite distance from the sun. As the comet recedes from the sun its velocity and kinetic energy get less and less. In these cases we are merely concerned with Newton's law; we assume that there is no conversion of kinetic energy into heat by friction. When elastic bodies collide there is a loss of visible kinetic energy in the system; this loss is merely a transformation into energy of vibration of the body and into heat. Some of the loss is due to the vibrations given up to the air, and communicated as sound; the energy of all these vibrations is eventually converted into heat, through imperfect elasticity and viscosity of the vibrating bodies. We may mention the conversion of mechanical work into heat by friction in the experiments of Rumford and Joule. Kinetic energy is converted into heat by friction between ordinary matter and the interstellar ether; Professors Stewart and Tait heated a disc by rotating it rapidly in a vacuum. Fresnel, in his hypothetical deductions by dynamical principles of the polarization of light by reflection and refraction, assumed the law of conservation of kinetic energy, and arrived at laws which are justified by experiment. The direct relations between mechanical work and heat are further referred to in the article THERMODYNAMICS. When any two bodies are in contact a certain definite difference of electric potential is established between them; this difference depends simply on the nature of the bodies. The bodies attract each other more than they did before, and this in virtue of their charges of electricity. More work has to be done in taking them asunder than was gained in letting them come together, and this work appears in the potential form of separate charges of electricity. In the electric machine, contact between a rubber and a

portion of a plate of glass creates a separation of electricities, and when the rubber and plate are removed from one another the separate charges may be collected. The electrophorus gives us another good instance of the conversion of mechanical work into potential energy of separated electricities. (See also POTENTIAL.) Kelvin, in the Bakerian Lecture (1856), states that the primary cause of all friction is a separation of electricities. A mathematical investigation shows us that the potential energy of a charge of electricity is proportional to the square of the quantity of electricity in the charge, and thus the experimental law—the heat evolved by an electric discharge depends on the square of the charge—accords with the principle of conservation of energy. Readers who care to see how the great experimental laws of physics accord with the theory of energy ought to read carefully the first two chapters of Tait's *Thermodynamics*. We give a short list of the most interesting examples: Green's law for the capacity of a Leyden-jar; Kelvin's no-liquid mechanical galvanic cell; Faraday's and Kelvin's laws of electrolytic action; the actions of magnets on one another; Arago's rotating copper disc; the mutual action of magnets and currents of electricity; magnetization by currents; Seebeck's discovery and Kelvin's development by the laws of energy, as experimentally verified by Le Roux. Lord Kelvin and Helmholtz showed independently that Faraday's laws of induction may be immediately deduced from Oersted's results by means of the laws of energy. Applications of this kind are every day indicating how to co-ordinate some newly-discovered fact, and even occasionally to predict the result of a perfectly novel experimental arrangement.

PRINTERS, LAW RELATING TO. Various restrictive measures having reference to the rights of printers are at present in force. A printer has no right to publish any work he has in his hands; but he has the power of retaining the printed sheets until the price of his labour be forthcoming. The statute 39 Geo. III. cap. lxxix. (amended by 51 Geo. III. cap. lxxv., and 2 and 3 Vict. cap. xii.), entitled *An Act for Suppressing Seditious and Treasonable Practices*, provides, in order to suppress seditious publications, that every type-founder and printing-press maker must, before commencing business, give notice to the clerk of the peace for the district in which the same is to be carried on, and obtain from him a certificate of registration, failing which he is liable in a penalty of £20. Such persons must also under the same penalty keep, and produce to any justice on his written demand, a statement in writing of the purchasers of their types or presses. The same penalty is also incurred by any person (except the queen's printers and the printers at the university presses of Oxford and Cambridge) who uses a printing-press or types without having the fact duly registered by the clerk of the peace. The printer must also write the name and residence of his employer on one copy of any book or paper he prints, retaining this copy for six months after it has been printed, and producing it when required to do so by any justice of the peace; otherwise he is liable in a penalty of £20. Every printer who shall print a book or paper without having his name and residence on the first or last leaf thereof shall, by act 2 and 3 Vict. cap. xii. s. 2, forfeit £5 for every copy printed. Certain papers are exempted from the operation of these acts, such as papers printed for the use of Parliament by its authority, or by authority of any public board or officer, or law proceedings, bankrupts' bills, receipts, securities for money, policies of insurance, letters of attorney, deeds of agreement, bills of lading, impressions of engravings, advertisements of tradesmen or of sales, &c.

PRINTERS' INK. See **INK.**

PRINTING, in a general sense, is the art of stamping impressions of figures, characters, or letters, with ink, upon paper, vellum, silk, or any similar substance; in a more particular sense it is the term applied to that art by which, with single movable letters or types, any piece of literary composition is represented on paper. Printing, in its extended sense, thus embraces the taking of impressions of wood and copper-plate engravings, mechanically or chemically engraved metal plates, lithographs, and even the decoration of calicoes; but the last two subjects are treated under **LITHOGRAPHY** and **CALICO-PRINTING**, and we shall here consider mainly printing in its most common meaning, that is, *typography*, or the art of printing on paper with movable metal types, wood blocks, or other surface engraved in relief. This is most generally known as *letterpress* printing.

The rudiments of printing were undoubtedly known to the ancients. It was practised in the East from a very early period. It is evident from undecayed bricks which have been found, having various symbolical and hieroglyphic characters impressed upon them, that a rude kind of printing was known to the Assyrians. Stamps for impressing bricks have been discovered which were engraved 3750 B.C., and a series of stamped blocks which cannot be dated later than 5000 B.C. (Petrie, *Syria and Egypt*, 1898; and King, *Letters and Inscriptions of Khammurabi*, 1898). A method of printing from raised surfaces was invented in China nearly a thousand years ago. The work intended to be printed is transcribed upon thin, transparent paper; each written sheet is pasted, with its face downward, upon a smooth block of wood. When the paper has dried on the board, it is rubbed off with the wetted finger, leaving every character delineated. The engraver then cuts the wood away in all those parts upon which he finds nothing traced, and thus leaves the transcribed parts ready for printing. Thus there must be as many blocks as there are pages in a book, and these blocks are not of the least use in printing any other work. The Chinese claim that a native blacksmith, Pi Shing, who lived about 1000 A.D., invented movable types and printed books with them, but the method did not supersede block-printing, which is in favour up to the present day. Labour is cheap, and these blocks are not costly; while the peculiar ideographic character of Chinese handwriting is not well adapted for reproduction by movable types. A large quantity of typographic printing has of late, however, been done in Chinese characters, but chiefly by foreigners. The ancient Romans made use of stamps, with characters engraved in relief, to mark their articles of trade and commerce; and Cicero, in his work *De Natura Deorum*, has a passage in which he points out how absurd it would be to look for an intelligent sentence from a careless mixing up of the engraved letters of the alphabet. He calls these *formæ literarum*, the very words used by the first printers. The ancients, however, had no suitable ink nor paper; otherwise printing as we now regard it might have been practised ages earlier than it was invented.

Block-printing in Europe, with single pieces of wood, can be traced back as far as the thirteenth century. The introduction of playing-cards early in the fourteenth century is supposed to have given an impetus to the art of wood-engraving. From single figures the professors of the art came to engrave historical or biblical subjects, some with a text or explanation subjoined, others without a text. A description, with facsimiles, of these is given in

De Vinne, *Invention of Printing*, 1876, and in many English and foreign works on xylographic prints. These books of Images, as they were called, may be considered as the earliest attempts at book-printing in Europe; and they resembled Chinese books in one essential point, each leaf being printed from single blocks of wood. The great discovery was yet to be made, which was to emancipate the art from its fixed thralldom, and give it a pliability and power beyond all previous conception—the discovery, namely, of the practicability and utility of adopting *movable* types of metal, cast from matrices in a mould.

It is a matter of much dispute to whom is due the merit of making this, in its results, unparalleled discovery. Nor, after all that has been written on the subject, can a very distinct or satisfactory conclusion be attained. Many claims have been adduced, but the real question seems to lie between those of Laurence Coster of Haarlem and John Gutenberg or Gensfleisch of Mainz, all others being groundless or puerile. The advocates for Haarlem maintain, chiefly on the authority of Hadrian Junius, *i.e.* Adrien de Jonghe, in his *Batavia*, 1588, that Coster before 1440 practised the art of cutting movable types of wood and printing books from them. But no undoubted specimen of his work has come down to us. A number of books or fragments of books, which bibliographers call *Costeriana*, are extant, however, which may be attributed to a very early Dutch school of typography. The latest researches into the invention of printing have been made by Dr. J. H. Hessels of Cambridge, and are given in his work entitled *Haarlem the Birthplace of Printing*, not Mentz (London, 1887); but his conclusions are not endorsed by the partisans of Gutenberg. The claims of the latter are set out in a large and sumptuous work by Dr. Van der Linde (*Geschichte der Erfindung der Buchdruckkunst*, Berlin, 1886, under the patronage of the German government). It is herein attempted to be proved that to Gutenberg belongs the credit of having first employed movable metal types in the production of books—of having, in short, been the first to supplant the ancient, tedious, and expensive method of manual transcription by letterpress printing. Gutenberg was a native of Mainz, but his early life was spent at Strasburg. He may have first conceived the idea of his invention, and made a few experiments of it at Strasburg, but at Mainz he brought the art into practical use. The ascertained facts concerning his career are extremely meagre. (See **GUTENBERG**.)

The first German presses, after Mainz, were at Strasburg, to which the secret of printing first spread, and Bamberg, where Pfister set up a press in 1461. In 1462 Mainz was sacked by Adolf von Nassau, and the printers working there were dispersed, and carried abroad their knowledge of printing. Soon after, the art was practised in different European countries. It was introduced into Italy (Subiaco) in 1465 by two Germans, Conrad Sweynheim and Arnold Pannartz; into France (Paris), 1470, by three Germans, Martin Crantz, Ulric Gering, and Michael Friburger; into the Low Countries, in 1473, by Nicholas Ketelaer and Gerard de Leempt; at Utrecht, and simultaneously at Alost, by Thierry Martens; into Spain (Valencia), 1474, by an unknown printer; Denmark (Odense), in 1482, by John Snell; into Portugal (Lisbon), in 1489, by Loria and Elzezer; into Sweden (Stockholm), in 1495, by John Fabri. (Duff, *Early Printed Books*, London, 1893.) Of its rise and progress in England and Scotland we shall come to speak immediately.

The types of the earliest specimens of printing—

an indulgence, of 1454; a Latin Bible, finished at Mainz, 1456; and another Bible, before 1459, which was printed separately or jointly by Gutenberg, Fust, and Schoffer—were in imitation of the pointed Black-letter preferred for the services of the church. A simpler form of Black-letter, which has been called Round Gothic or Semi-gothic, was used for books to be bought and read by the laity. The first printers at Rome used letters of Roman style, but with many of the features of Black-letter, the first good Roman being shown by Jenson of Venice in 1470. Italic was a new form of printing type, selected by Aldus Manutius from the cursives of the copyists, and used for the first time in 1501.

In Fust and Schoffer's edition of Cicero de Officiis (Mainz, 1465) Greek types were first used, but the first book wholly printed in Greek was the Grammar of Lascaris by Paravisinus (Milan, 1476). The first Hebrew types appeared in 1475 in a work printed by C. Fyner at Esslingen in Wurtemberg. The first entire Hebrew Bible was printed at Soncino, Italy, by a family of German Jews in 1488. The first polyglot Bible—the Complutensian Polyglot, in 6 vols., in Hebrew, Latin, Greek, and Chaldean—was printed at Alcalá in 1517 at the charge of Cardinal Ximenes. Some of the earliest printers were themselves men of learning—amongst them Froben (printed 1491–1527) at Basle, Aldus Manutius (1494–1515), some of the Estiennes (Stephenses), and the Elzevirs. Learned men, too, were proud to act as correctors of the press. Thus, Erasmus revised and edited the press of Froben; B. Aras Montanus corrected the *Biblia Polyglotta* of Plantin.

In the earliest books the style and even the mannerisms of the scribes, who made all books previous to the invention of typography, were followed by the printers. As an example, reference may be made to the first edition of one of the most popular and most read books in the world, the *Imitation of Christ*, by Thomas à Kempis, printed at Augsburg in 1471, during the lifetime of the author. The type is very large, equal to that of a large lectern Bible of the present day. The pages are of excessive blackness, the large type affording more surface for inking than the small type used at the present day. The pages are solid, without breaks for paragraphs. The paragraphs are indicated by red strokes through the initial letters, painted in. There are no chapter headings, but the beginnings of the chapters have large initials in red, which were done, not by the printer, but the rubricator or illuminator. Early books, before being issued, were placed in the hands of men whose business it was to illuminate or embellish them. Many useful features of the modern book were not then thought of, there are no folios, no headlines, no appearing signatures. There are an extraordinary number of abbreviations, made on no intelligent system—many words being cut short—on the Procrustean principle—to get them into a line. A great number of single letters with a small horizontal stroke over or under them are used for affixes and prefixes, as *o* for *om*, *q* for *que*, *e* for *et*, &c., which make the reading of the book very tedious. The only punctuational points are the full point and colon. There is no preface; no marginal or foot notes, no title-page.

Gradually the printers emancipated themselves from the styles of the manuscripts, and began to invent features tending to elegance and lucidity. Very contradictory accounts are given by bibliographers of the first introduction of these improvements in bookmaking, but the following particulars may be regarded, probably, as most authentic. They are from addresses by Dr. Copinger before the

Bibliographical Society, and the late George Bullen before the Library Association.

The last step towards the completion of the printed book was made in 1487, when a book was printed at Strasburg, probably by Martin Flach, with a regular title-page.

The first book with a preface was one printed at Rome by Sweynheym and Pannartz.

The earliest books were costly and cumbersome folios; afterwards quartos were introduced, first perhaps by Fust and Schoffer. Aldus Manutius was the first printer to replace these by the convenient crown octavo, at a moderate price, which brought them within the reach of nearly all students, and greatly helped to popularize the knowledge and the influence of classic literature.

Signatures—single letters printed on each sheet, in alphabetical sequence, to show the binder the order of the sheets—were known long before the invention of printing; indeed they were used in manuscripts from an early period. In binding, many early books have had the edges so much trimmed that the signature has been cut off, hence the mistaken impression that signatures were not used by some of the early printers.

Numbered leaves are usually stated to have been first used by A. Ter Hoernen at Cologne, 1470. A development of this practice was the numbering of pages.

Marginal notes are first used in a book printed at Rome by Sweynheym and Pannartz. Sometimes the notes were placed around the text.

Catch-words are found in a book by J. de Spira, Venice, 1469.

The first book containing a printed date of issue was the *Psalmorum Codex* of Schoffer, 1457.

Running titles are said to have been introduced by Ter Hoernen in 1471, but this is perhaps inaccurate.

In regard to punctuation, improvements made by one printer were not followed by others. It was not until about the year 1470 that the mode of punctuation used at the present day was approached. The first book printed in France contained full point, semicolon, comma, parentheses, notes of interrogation and admiration, the colon being wanting.

Some small religious pictures known as 'Images of Pity' were printed in England in the early part of the fifteenth century. They are merely examples of block (or xylographic) printing. From the first Oxford press there was issued a book bearing the date (in Roman numerals) of 1468. This has been conclusively proved to be a printer's error; an X having been omitted: the true date being 1478. The first book actually printed in England was dated 1477. The title is, 'The Dictes and Sayings of the Philosophers': it was printed at Westminster by William Caxton.

Little is known with certainty of the career of Caxton, the English proto-printer, but the main facts of his life will be found in the article CAXTON, WILLIAM. The standard authority on the subject is the monograph by the late Mr. William Blades, 'The Biography and Typography of William Caxton', of which the latest edition was issued in 1882. Practically nothing further to add to the memoir has since been discovered, although a few minor products of his press have since come to light. Born in Kent, he received a good education for the times, and was apprenticed to a London mercer. In 1441 Caxton left England, and continued for about thirty years to reside in the Low Countries, then the wealthiest part of Europe. Latterly he was patronized by Margaret, sister of the king of England, and wife of

Charles the Bold of Burgundy, and this lady is said to have urged him to translate into English a romance on the destruction of Troy. This he did, and having become acquainted with the printer Colard Mansion, of Bruges, there was produced from the press of the latter, about 1474, the 'Recuyell of the Histories of Troy'—the first book ever printed in the English language. He soon began another book, a translation into English of a French translation of a little work in Latin, called the 'Game and Playe of the Chesse', the second book printed in English. Intending to return to his native country, Caxton employed Mansion to provide him with a fount of types similar to those already used in his books. In 1476 he arrived in England, and immediately set up his press at Westminster. In 1477, as already mentioned, he issued the 'Dictes and Sayings', a collection of witty sayings and proverbs. After this he printed in quick succession a large number of works. Caxton's introduction of the new art into Westminster is not referred to in any known contemporary document, and he nowhere makes it appear that he was practising a great art. He cannot have conceived the future that was in store for printing. He did not suspend his labours till death overtook him, and he lived to see competitors, and the art thoroughly established in his native country.

Caxton's two most distinguished successors were Wynken de Worde and Richard Pynson. The former, a native of Lorraine, served under Caxton, and after the death of his master came into possession of his materials, and successfully practised the art of printing on his own account. The books which he printed were chiefly small ones of a popular character, intended for the general public. He died about 1534. Pynson was a native of Normandy, and it is supposed that he also served under Caxton. The first book of his which is known with a date, states that it was printed in 1493. His last dated book was issued in 1529. The works which he printed are neither so numerous nor so beautiful as those of Wynken de Worde. He was the first printer, however, who introduced the Roman letter into England, in 1518. To Wynken de Worde and Pynson succeed a long list of ancient typographers, into which we cannot enter here. See Mr. Robert Proctor's Index to the Early Printed Books in the British Museum and at the Bodleian (London, 1898).

The art of printing was introduced into Scotland in 1508, when a printer and bookseller, Andrew Myllar, established a press in the South Gait at Edinburgh. Previous to this he had employed a foreign press to print books for him, that of Pierre Violette of Rouen. At this time there were very close business relations maintained between Scotland and France. With a view to printing on his own account, Myllar went to Rouen and purchased a fount of types, returning with them to Edinburgh. In 1508 he issued a series of nine poetical pamphlets, containing wood-cuts. The only known copies of these are now preserved in the Advocates' Library, Edinburgh.

About this time William Elphinstone, Bishop of Aberdeen, was desirous of having printed his own adaptation of the *Sarum Breviary* for the use of his own diocese. Andrew Myllar, in conjunction with a wealthy merchant, Walter Chepman, who supplied the necessary funds, undertook the work, which was issued in 1510, in two vols. of 400 and 378 pages respectively. Four copies of these books are known, but none of them is perfect. After this no more books were printed in Scotland for several years. In 1540 Thomas Davidson obtained from James V., king of Scotland, grants to print the new

acts and constitutions of parliament. In 1541 this printer produced the 'History and croniklis of Scotland, with the cosmography and dyscription thairrof. Compilt be the noble clerk, maister Hector Boece, channon of Aberdeene'. The history of Scottish typography is to be found in Robert Dickson's Introduction of the Art of Printing into Scotland (Aberdeen, 1885); and Dickson and Edmond's Annals of Scottish Printing (Cambridge, 1890).

Ip later days Scotland has distinguished itself by the extent and beauty of its typographical productions. Thomas Ruddiman, who flourished at Edinburgh from 1724 to 1757, was one of the most learned printers which any country has produced. The works which he edited and printed are numerous, and they are all remarkable for their accuracy. Edinburgh can boast of many other typographers; nor has Glasgow been behind in this labour of love. Perhaps the most celebrated of her printers were the brothers Robert and Andrew Foulis (printed 1740–1776), who produced in their day some of the finest editions ever printed. Their classics, Greek and Latin, were as remarkable for their exactness as their beauty. These printers followed the examples of some of the old masters by publicly exhibiting their proof-sheets and offering a reward for the detection of any error.

It was long after the invention that printing was introduced into Ireland. In 1551 the Common Prayer was printed in Dublin by Humphrey Powell, 4to, black letter, and this is the earliest recorded production of the Irish press. Until as far down as 1700 very few books were printed in Ireland. Alderman George Faulkner, who printed in Dublin 1726 to 1775, may be considered as the first eminent Irish printer. At the present day much fine book-work is printed in Dublin, Belfast, and other places.

Process of Letterpress Printing.—Every letter, point, and mark used in printing (with one or two exceptions) is cast in metal on a distinct body or stalk, each of these pieces forming a *type*. (See TYPE-FOUNDING.) For the use of the printer numbers of these types are placed in cells or boxes, in order, in a shallow tray or case, in such a way that any letter or point may be found with the greatest convenience. These cases are mounted on a stand or frame, so that they may lie before the person who is to select the types, and the little cells or boxes are so arranged that those containing the types most frequently used shall be nearest to the workman, who is technically styled a *compositor*. The sizes of the boxes are made larger or smaller according as the types which they contain are more or less largely required.

The types mostly used for printing books and newspapers consist of the letters of the alphabet, of which there are three kinds—

Capitals, *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Æ Œ*.

Small capitals, *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Æ Œ*.

Lower-case, *a b c d e f g h i j k l m n o p q r s t u v w x y z æ œ*.

The above are Roman letters; we have the same in Italic, but in it small capitals are not regularly cast.

Capitals, *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Æ Œ*.

Lower-case, *a b c d e f g h i j k l m n o p q r s t u v w x y z æ œ*.

There are also so-called *ligatures*, as *ff*, which are cast on one stalk; besides Arabic figures, the points, the reference marks and signs, and accents for occasional use. Besides these there are many varieties of letter, such as Old English, imitations of

manuscript letters, &c. A great variety of fancy types are used for the purposes of display or emphasis in 'jobbing' or miscellaneous commercial printing. A collection of types, such as is necessary in ordinary circumstances for carrying on the printing of a work, is called a *fount* or *font* or *fonte* (from the French *fonte*, a casting). A fount must contain not only a sufficient number of letters, points, and figures, but likewise blank types to fill up spaces, and other peculiarities.

Types are of various sizes, the following being those commonly in use among British printers for regular book work:—English, Pica, Small Pica, Long Primer, Bourgeois, Brevier, Minion, Nonpareil, Pearl, Diamond. Of these various sizes we may give specimens, by printing a portion of the Lord's Prayer.

ENGLISH.

Our Father, which art in hea-

PICA.

Our Father, which art in heaven,

SMALL PICA.

Our Father, which art in heaven, Hal-

LONG PRIMER.

Our Father, which art in heaven, Hallowed

BOURGEOIS.

Our Father, which art in heaven, Hallowed be

BREVIER.

Our Father, which art in heaven, Hallowed be thy

MINION.

Our Father, which art in heaven, Hallowed be thy

NONPAREIL.

Our Father, which art in heaven, Hallowed be thy name

PEARL.

Our Father, which art in heaven, Hallowed be thy name Thy king-

DIAMOND.

Our Father, which art in heaven, Hallowed be thy name Thy kingdom come. Thy will

It may be useful to add, that if there are no spaces between lines, that is, if the matter is solid or 'not leuded', the following is the approximate number of lines that go to a foot.—English 64; pica 72; small pica 83; long primer 90; bourgeois 102; brevier 110; minion 122; nonpareil 144; pearl 180; diamond 204. The size of type used in printing this article is brevier.

Composing.—When a work is to be printed and the size of type and page determined upon, the 'copy' is given to the compositor, who places it before him on the case, reads from it, and lifts out the types in proper order, placing them in a little frame of metal which he holds in his left hand. This little frame is called the *composing stick*, one of its ends is movable, so that by means of a screw it may be fixed at a distance from the other equal to the breadth of the page or column. First one line of types and then another are placed in the stick, and the compositor continues the process of setting until the stick will not conveniently hold more. The type matter is now carefully slipped out and slid on to a long flat board with two side ledges to support the type, and the same process is continued. In order to prevent the compositor from turning the type the wrong way, or to prevent the letter from being inverted, a notch or nick is cast on the same side of each sort of types, which guides him to place it right.

When a convenient quantity of matter has been composed, or *set* as it is technically called, the

VOL. XI.

workman binds the types together by tying a cord round the whole. This is done while the types are on the ledged board spoken of, which is called a *galley*. After a proof has been printed or 'pulled', an impression is taken and submitted to the inspection of a corrector, who, by minute examination and comparison with the copy, endeavours to detect, and point out by marginal references, all the errors that the compositor may have committed. This is called the first reading of the proof; and when the compositor has gone over the types, and made the necessary alterations, a second impression is taken, called the *revise*, which is also inspected by the corrector. According to circumstances two or more revises are made; and when the corrector is satisfied, the last revise is sent to the author to receive his corrections, which are attended to by the compositor and the corrector. (See CORRECTION OF THE PRESS.)

The matter is then divided into portions each equivalent to a page, and tied up. These pages are transferred to a large table of iron planed quite smooth. This table is furnished with drawers containing *furniture*, that is, materials for fixing the pages in the positions required for printing; consisting of *side-sticks* and *foot-sticks*, being rectangular pieces (or lengths) of wood or metal thicker at one end than the other, small wooden wedges called *quoins*, pieces of wood called *reglets*, &c.

The compositor having laid down the pages of type on the table in proper order, proceeds to adjust them firmly in a rectangular frame of iron, called a *chase*, and the process of fixing the pages is called 'imposing'. The chase being placed so as to begird the *form* (that is, the assemblage of types in the chase), the next object is to secure the pages at a proper distance from each other. This is done by placing between them some of the rectangular pieces of wood or metal referred to above; the distance being so regulated as to give the work to be printed a proper margin after it is bound. The interior portion of the form being now finished, the outer edges are next adjusted, by placing side-sticks and foot-sticks to them, and the whole is firmly secured within the chase, after being properly adjusted, by driving in the quoins. This last process is called 'locking up', but before it is done care is taken that all the types shall form a perfectly level surface, which is ensured by placing over them a flat piece of wood or a planer, and striking it down with a wooden mallet.

The compositor must arrange the pages and fix them in the chase, in such order that when the impression is taken off, and the sheet folded, the pages will follow each other in proper order. There being two sides in a sheet, and eight or perhaps sixty-four pages on each side, some consideration is required to lay down the pages properly. On examining a printed sheet uncut, containing sixteen or thirty-six pages, this will appear at first sight a very intricate matter, and it must be owned that where the pages are numerous in a sheet the arrangement of the pages (that is, the imposing) requires, even from the most experienced compositors, care and consideration. The process of imposing is, however, based upon a simple law, which, if applied, cannot fail to guard against mistakes in the arrangement of the pages. In order that the reader may see that there is a regular system or law observed in laying down the pages, we will subjoin specimen plans of the pages of a sheet of 8vo, 12mo, and 18mo; that is, of sheets consisting of sixteen, twenty-four, and thirty-six pages. Other arrangements of the pages are often made to meet certain requirements. It must be premised, however, that, the sheet being printed on both sides, that side which

being introduced, and the machine is rapidly being brought more extensively into use. A very large proportion of our typographical matter is now produced without the use of types—which for producing the body or text of newspapers, &c., seems to be superseded by the composing of matrices, as wood-engraving has been by the chemical methods of producing plates, known as process blocks.

Mechanism of Printing.—The mechanism of letter-press printing, at first of the simplest possible kind, has made remarkable advances in recent years, having received the attention of some of the first inventors and mechanics. Three methods have been followed for obtaining the impression which produces the printed sheet. The first and simplest is by the advance against each other of two flat surfaces, one carrying the type-form and the other the blank sheet to be printed. The second is by the rotation of a cylinder above a table which travels backwards and forwards, and which is in contact with the cylinder in advancing, but free in returning; the table in this case carries the types while the cylinder brings into contact with them the blank sheet. The third and most recently adopted method is the contact of two cylinders constantly revolving in the same direction, one carrying the type-surface on its circumference, and the other bringing against it a continuous web of paper which is afterwards severed into sheets. Machines working on the first method are called *platen* machines, on the second *cylinder* machines, and on the third *rotary* machines. The last are also called *web* machines, because the paper they print is not cut into sheets, but is in the form of a long web or reel—sometimes two or three miles in length if extended.

The Hand-press.—It may be well to give, in connection with the hand-press, the details of the process of making ready and printing a form of types, a process common to all machines, with certain obvious modifications. The paper to be printed is sometimes damped with clean water before it is subjected to the action of the press, in order that it may be softened, and thus accommodate itself to the surface of the types. A few sheets are dipped in a trough of water and laid upon a board, a few dry sheets are laid over these, and then a few wet ones, and so on until the whole are piled up in a heap. They are then put into a common screw-press in order that the water may be pressed uniformly through them. The degree of damping will depend on the nature of the paper and other circumstances which experience alone can regulate. Paper is now generally printed from when dry. To enable this to be done satisfactorily the surface is calendered or coated, rendering it more sensitive to the ink.

If book-work is being printed, the pressman first lays the inner form on the press and prints one copy, which is called a *press revise*; this he takes to the person appointed to revise it, and while the revision is being done secures the form on the table of the press; takes the steps afterwards described as necessary to produce a uniform impression over all the pages; fixes the points, which make small holes in the paper that enable him to cause the pages to fall precisely on the back of each other when the second side of the paper is printed; and cuts his *frisket*, an iron frame filled in with paper, hinged so that it can be folded upon the blank sheet to cover it over, except the parts to be printed. When the revise is corrected he proceeds to ink the surface of the types by means of a roller, lays on them a blank sheet of paper, folds over the frisket and its support the *tymp*an, and runs the carriage of the press under the platen, the downward squeeze of which causes the ink on the types to adhere to the paper, and the

latter is then withdrawn. After one side of the paper is thus printed to the required number the pressman lifts the form off the press, washes the ink off the face of the type with lye, and rinses with water. He then proceeds in a similar manner with the outer form, thus completing the sheet. This process is continued sheet after sheet till the work is complete.

The first impression obtained is generally very irregular—in some parts of it the type may have almost gone through the paper, while in others the ink can scarcely be seen. The plan adopted for remedying this defect, called *making ready*, forms perhaps the most important part of the pressman's duty, and in finer work and in woodcuts (where it serves an additional purpose) it often taxes his utmost skill. The process is commenced in the case of stereotype plates by placing pieces of thick paper between the plate and the block below it, to bear up the parts which are very low. When this has been done as completely as can be judged from the appearance of the first impression, a second impression is taken to show the result and to guide in further *underlaying*, as it is called. When the impression has thus been brought to a rough equality it is somewhat similar to the first impression obtained from a form of movable types, and the mode of procedure is changed. Pulling a sheet from the form, the pressman lays it on a cutting board in a good light, with its bottom or rough side uppermost, so that the impression may be easily seen. He then with a sharp-pointed knife cuts away the parts of the paper that are too heavily impressed, and pastes pieces on those parts which are too light. The sheet being finished (now called the *skeleton* or *overlay* sheet), is so placed in the press as to be exactly above the types when sheets are being printed. A second sheet is now pulled, showing the progress that has been made, and it is treated in precisely the same manner. The number of times which this is repeated depends mainly upon the *quality* of the work which it is intended to produce, varying from one to three, four, or even six sheets, the result being that the impression is perfectly regular, and, supposing the types to get an equal amount of ink, the printed sheet shows but one shade of colour.

Making ready woodcuts, as already indicated, serves another purpose, and requires more skill and care. On glancing at an engraving, say a landscape view, it will be seen that some parts of it are light and open, such as clouds and objects in the distance, while others are heavy and black, as figures and buildings in the foreground. The amount of pressure necessary to bring up these latter parts would be very much too great for the former, making them coarse and blurred; besides that, with an equal impression it would be impossible to give the nice gradations of shade observable in a first-class engraving. Here comes in the process of making ready. A sheet is pulled from the block to be worked, and on the back of it are fixed by the corners several layers of paper, varying from three to six, according to the variety of light and shade in the subject. The workman then proceeds to cut away the layers of paper from certain parts, taking out one, two, three, or more layers as he wishes them made more or less light. This skeleton picture constitutes an *overlay*, and when finished it is placed in the same way as the skeleton mentioned above; the sheet next pulled will obviously have more or less pressure according as the layers of paper have been more or less entirely cut away. This, however, is generally very far from sufficient, and to complete the making ready, sheets are successively pulled and singly cut out in a similar manner until the desired result is obtained.

A new method of overlaying has been experimented on lately with success. The pasting down on the skeleton of pieces of paper as above described is done away with, and instead an impression, called a foundation sheet, is painted with a strong paint, which is laid most thickly on the spots where the full blocks are, and less thickly on the middle tints. The advantage is, that the overlay can be applied more quickly than by the building up manner, for in a few minutes the paint, which may be prepared with shellac varnish or liquid fish-glue and ammonia, dries very hard, leaving a perceptible relief.

It should be mentioned that wood-cuts are now seldom or never printed from direct, for two amongst some other reasons. An accident to their surface is almost irreparable, except by the tedious and unsatisfactory expedient of cutting out the damaged part, inserting a new plug of wood, and engraving it anew. The wood block, too, wears out—that is, the fine lines become thickened in the process of impression. Wood engravings are now *electrotyped* (see ELECTRO-METALLURGY), and the electrotpe gives us good impressions as the original. An enormous number of prints can be taken from an electrotpe, while the wood block, not having been used for printing, always remains as good as new, and any quantity of plates can be made from it. But the vast majority of illustrations in our books and pictorial newspapers are not produced, as was formerly the case, from wood engravings, but from what are called 'process blocks'. The method by which these are produced is described in the article PHOTOGRAPHY. They are made ready practically in the same way as wood-cuts.

In former times, in printing by the hand-press, the ink was put upon the types by means of two stuffed leather balls on which some ink was spread, a process of extreme tediousness. Instead of the balls an elastic roller or cylinder is now in general use. This roller derives its elasticity from a covering of a composition formerly made exclusively of treacle and glue, now generally of glycerine and glue. The ink is spread upon an iron table, from which a part is taken on to the roller and applied to the form of types every time the carriage of the press is drawn out. Two workmen are usually engaged at the same time at one press, the one distributing the ink on the types, while the other is engaged in pulling the impressions.

The press used by Gutenberg was probably of a very rude description, and would appear to have been little better than a cheese-press. The pressure was obtained from a screw, but as this screw must have come down with a dead pull, there was great danger of injuring the types. Various improvements were from time to time introduced, but Charles Mahon, the third earl of Stanhope, was the author of the first really great improvement in printing-presses, about 1800. He devised a series of levers, which he applied to the old screw-press. These levers brought down the platen with greatly increased rapidity, and what was of still greater importance, converted at the proper moment that motion into pressure. The pressure was under great control, and capable of easy adjustment. The press was of iron, and not of wood as was the case with all previously constructed presses, and it exhibited a number of contrivances of the most ingenious character for facilitating the work of the pressman. In 1813 John Ruthven, a printer of Edinburgh, patented a press with several decided improvements, in which the form was placed on a stationary table, instead of a running one, as in previous presses. The pressure was obtained, not from mechanism, as a screw and levers, above the form, but beneath

the table. This departure from the principle of all hand-presses may to some extent have suggested the more recent 'platen machine' to be referred to presently.

The Columbian Press, invented in 1814 by G. Clymer, Philadelphia, was introduced into Great Britain in 1817. In this press the power is obtained solely by a system of levers, without the intervention either of screws or inclined planes. It is reputed to be the most powerful of hand-presses, the workman being able to print or 'pull' with it a heavy form with comparative ease. It is, however, defective in durability, several of its parts being liable to break even although manufactured with the greatest care.

The Albion press, brought out by R. W. Cope, a London engineer, in 1820 (Plate I., fig. 1), in its improved form combines the essential requisites of a printing-press—speed, easy pull, and durability in a high degree. The impression is given by means of what is called a knuckle-joint. In their normal condition the two parts of this joint lie at a slight angle to each other. When they are brought into line their entire length is consequently increased, and to that extent they are made to depress the platen. The return of the platen is effected by a strong helical spring inclosed in the central upright projection seen in the engraving.

The great labour required to work the hand-press, even in its most improved form, as also the slowness of the process, two workmen not being able to throw off more than 250 impressions an hour, rendered it desirable that some more expeditious and easy method of taking impressions from types should be obtained, and owing to improvements gradually made in printing machinery the hand-press is used now in cases only wherein short numbers of copies of small forms are required.

Printing Machines.—So early as the year 1790 William Nicholson took out letters-patent for a printing machine. His plan consisted in forming the types with a tapering body or stalk, in order that they might be placed on the surface of a cylinder, and kept compact like the wedge-shaped stones of an arch. These types being placed on the surface of a cylinder, he inked the printing surface by means of inking-cylinders, stuffed with wool or other materials, and covered with leather. A machine on the principles described in his specification was never built, yet he deserves the credit of being the first who suggested the application of cylinders and inking-rollers. About ten years later Frederick König, a printer in Saxony, turned his attention to the improvement of the printing-press, but, failing to find support in his native country, he came to London in 1806. His invention was simply an improved platen press on the screw principle. He seems to have learned of the invention of Nicholson, and determined to adopt its principal feature—the discharging of the platen, and the use of the cylinder as the pressing surface. Having secured the collaboration of a distinguished printer of the day, Thomas Bensley, they made numerous attempts to bring the machine into operation, and two sheets of a book were printed in their office in 1812 on a König machine. The remarkable character of the invention reached the ears of Mr. John Walter of the Times, who went to see it, and forthwith ordered a machine to print his newspaper. The machine was accordingly erected, and on the 29th of November, 1814, the reader of the Times was informed that he held in his hand a paper printed by machinery moved by the power of steam. The machine had two cylinders, and printed simultaneously two copies of the newspaper on one side only. The two sheets were fed in at the two ends. The inking was

effected by providing a vertical cylinder with a hole at the bottom fitted with an air-tight piston, depressed by a screw. This forced the ink out on to two hard rollers covered with leather, between which it was distributed, and from which it was furnished to other rollers. The machine printed about 1800 impressions per hour—that is, 900 from each cylinder on one side of the paper only.

The enormous increase in the circulation of the Times newspaper demanded a corresponding increase in the speed of production, and a further improvement was made in May, 1848, by the adoption of a new machine constructed by Augustus Applegath, which threw off 10,000 impressions per hour. This machine had a vertical cylinder 65 inches in diameter, on which the type was fixed, surrounded by eight other cylinders, each about 13 inches diameter and covered with cloth, round which the paper was led by tapes, each paper or impression cylinder having a feeding apparatus and two boys tending. The ink-rollers were also vertical, working against the large cylinder, on which they distributed the ink. This last was in a vertical cylinder. The type used was the ordinary kind, and the form was placed on a portion of the large cylinder. The surface of the type formed a portion of a polygon, the sides of the polygon corresponding with the newspaper columns, and the regularity of the impression was obtained by pasting slips of paper on the impression cylinders.

The next step in advance was a machine invented in 1857 by Messrs. Hoe & Co. of New York and London, called 'The Type Revolving Fast Printing Machine'. It was not only more compact than the Applegath, but could be driven at a higher rate of speed. The cylinders were horizontal, there being from two to ten impression cylinders, the latter capable of giving nearly 20,000 impressions on one side of the paper only; but that rate was seldom long maintained. One new feature was that the takers-off were dispensed with, by the invention of self-acting flyers. These deposited the sheets upon tables or fly-boards, there being as many of these attached to the machine as there were impression cylinders. At first movable type was used, and it was ingeniously arranged on the larger cylinder. Each column of type was set up on the level, but six or seven columns, for a large newspaper, were nevertheless adjusted and secured side by side. All the columns of type were tightened up to occupy, in polygonal fashion, a portion of the circumference of the cylinder, the remaining portion affording space for the inking rollers to act. At a later date stereotype plates, each strictly conforming to the curvature of the cylinder, were used, with a great increase of speed and economy.

Repeated attempts had been made by various inventors to construct a machine which would print from the continuous roll or web in which paper is produced by the paper-making machine. Experiments were conducted successively by Nicholson, Stanhope, Sir Rowland Hill, Applegath, and others, but the difficulties for the time proved insurmountable. These, however, were at length wholly overcome, and the result was the construction of a class of machines which possess the merit of being at once simpler, more expeditious, of producing better work, and being more economical in requiring less expenditure of manual labour than any previous contrivance. In all machines printing separate sheets their speed was governed by the dexterity of the layer-on, and about one thousand per hour was the utmost that he could feed in. To produce large numbers from one machine it was necessary to multiply the impression cylinders, as in the Hoe machines already

mentioned; but when four or six cylinders were reached the complications became very great. The stoppages were frequent, the waste excessive, and the risk of accident to the machine and material very formidable; moreover, the expense of working these machines was very great. A machine working from the roll of paper is nearly independent of manual dexterity, and is regulated almost solely by the mechanical apparatus.

The first machine on this principle that established itself in a British printing-office was the 'Bullock', invented by William Bullock, of Pennsylvania, U.S.A., in 1865. It was, however, speedily eclipsed by the 'Walter Press', a machine invented and constructed on the premises of the London Times. The invention of this machine was due mainly to the combined ingenuity of Mr. John Walter, chief proprietor, Mr. John Cameron Macdonald, manager, and Mr. Joseph Calverley, chief engineer of the Times newspaper. The roll of paper used for printing the Times was about 4 miles in length, and weighed about 800 lbs. It was passed from the roll over a tension roller, and then over damping cylinders perforated with small holes, by which it became thoroughly wetted on both sides. The paper after being squeezed between rollers went to the printing apparatus. Four large cylinders were arranged one above the other. Two of these carried the stereotype plates, and two were pressing cylinders, these latter being covered with blanket. The paper was led between the top cylinder, on which were stereotype plates, and the top pressing cylinder, where one side was printed upon. Then it went round the lower pressing cylinder, and the other side was presented to the lower plate cylinder, and became printed on the back and perfected. A system of inking rollers, with the ink trough, was erected close to each of the stereotype plates, and inked them. Having been printed, the paper passed to cutting cylinders. A knife caught the web of paper just where it required to be cut into sheets, and cut it, all but a couple of tags near each end, which were left for the purpose of pulling the sheet on between running tapes, driven at a greater speed than the rest of the machine. These immediately tore the sheets apart where they had been all but separated, and the tapes hurried on what had now become a completely printed newspaper, to the delivery part, behind which a boy sat to watch and adjust the sheets as they fell.

This machine did not fold the papers, although afterward an apparatus for that purpose was added. In 1870 Mr. George Duncan and Mr. Alexander Wilson, of Liverpool, invented a machine called the 'Victory'. The paper after being printed on both sides ran along till it came to a cylinder containing a knife, which cut it from the web, and at the same moment it received its first fold. Thence it was carried to the grippers attached to the second folding cylinder, where it received an additional fold. It was then delivered to a series of other folding knives, and ultimately the folded papers were deposited at a rate of about 12,000 per hour, in receiving boxes. All these varied operations were carried on, and sheets 30 by 40 inches printed and folded at the rate of 200 per minute. In 1871 Messrs. Foster & Sons introduced a movable-type web rotary machine. The type was held on the type-beds on the same principle as that of the Hoe Lightning machine already mentioned. The principle was the same as that of the keystone of an arch, each column rule being supposed to represent a keystone. The object was the saving of expense in stereotyping and the saving of time, the forms being ready to be printed the moment they were locked up. Certain practical disadvantages, how-

ever, nullified this apparent saving, and the plan has since been entirely superseded.

It is necessary to pass over several inventions introduced at this time, the object of which was to expedite the web machine and to increase its productiveness. These did not possess any particular points of novelty, their improvements being details of engineering mainly. Within a few years, however, Messrs. Hoe & Co. again distanced all competitors. They first of all manufactured a machine for printing a web of double width, thus doubling the output. Then, in 1885 they patented combinations of two or more printing machines for producing at will papers of various sizes or numbers of pages, and later in the same year an apparatus called the 'former', for folding upon an entirely novel principle. By these inventions, for instance, three similar machines might be connected by tapes. These machines, so arranged, might all be employed independently to produce four- or eight-page papers, in each case folded, or twelve-page papers, by passing four-page sheets from one to another machine alternately, where they were associated and folded with the eight-page papers, or sixteen-page papers, by other combinations. These facilities mark the beginning of an important era in the history of fast newspaper printing. The adoption of stereotyping had made it possible to use as many printing machines in the production of a newspaper as was required to print the circulation in the requisite time. These machines were capable only of printing newspapers of four and eight pages. The cheapness of paper, competition, and enterprise led to newspapers being enlarged to twelve pages. Such issues could only be produced at two separate printings, the detached sheets having to be put together by hand. This caused delay and inconvenience. It was an enormous advantage to provide machinery that would produce newspapers of a varying number of pages, from 4 to 12 or 16, or even more, all inset, cut at the head, and folded in a convenient form.

Since 1890 several different arrangements have been adopted by engineers. Two presses have been erected at right angles to each other, forming one machine, known as a supplement or quadruple press. Two or more presses may work one above the other, with connection between each. These are known as two-decker and three-decker machines. There may be two or more presses, one behind another, and capable of being coupled to form a combined machine, on the 'tandem' system. Opinions differ, of course, as to the relative merits of these different types of machines, and it would be obviously uncalled for to enter into the discussion here.

At this time there are machines that produce papers of 4, 6, 8, 10, 12, 14, 16, 20, 24, and 32 pages. The papers are cut at the head, the insets or supplements pasted in; they are folded to quarter-page size, and counted. Some of them produce four- to eight-page papers at the astounding rate of 96,000 per hour (1600 per minute); 16 pages at 48,000, and 24 pages at 24,000 per hour. There are also web machines which print the inside of a magazine and the coloured wrapper, folding and sewing them at the same time. Other machines print in several colours simultaneously. To the productiveness and adaptiveness of machines on the web principle there seems to be practically no limit.

An example of this adaptability of the rotary system is provided in the illustration (Plate II., fig. 2) of the machine called the 'Sextuple Press', manufactured by Hoe & Co. It prints from three rolls of paper, each double the width of the newspaper, and, in the case of an 8-page issue, at the rate of 72,000 copies per hour. The papers are

folded as required, ready for publication. It may also be used for printing in three colours simultaneously. In this case one roll of paper only is supplied, and three electrotypes of the colour-plates are placed on the cylinders, instead of the stereotypes from letter-press, when black forms are worked. Periodicals can be printed in 8- or 16-page form, with half of the pages in colour and half in black, folded, pasted, or wire-stitched, counted, and delivered in book shape. Multicoloured newspapers and periodicals are increasingly issued in vast numbers in the United States, but few as yet in Great Britain.

In fig. 4 of Plate I. we have given a view of a 'perfecting' cylinder machine—that is, a machine which prints the sheet on both sides before ejecting it—used in many book-printing offices. It is moved by a steam, gas, or other engine, the power being communicated by a belt passing round a pulley placed in the opposite side of the machine from that represented in our view. The machine requires the attendance of two boys, one to deliver the sheets to be printed, and the other to receive them after the impression. The feeding boy brings the edge of each sheet of blank paper between two systems of endless tapes at a point where they open to receive it; at a given instant these close, grip the sheet, and carry it into the machine. The endless tapes are adjusted so as to lie upon the sheet on those parts only that are not to be acted on by the types, or in other words, the tapes touch only the margins and the divisions between the pages, in order that they may hold the paper during the whole of its progress through the machine. The use of these two systems of tapes is to keep the sheet in its proper position during the process, and thus to ensure an accurate *register*, or the exact placing back to back of the pages on both sides of the sheet. The most prominent parts of the machine are two large cylinders and two intermediate smaller cylinders, round which the system of tapes which we have spoken of above pass, and carry with them the sheets of paper to be printed. These four cylinders revolve upon axes supported by the framework of the machine. The use of the intermediate cylinders is to effect the turning of the sheet, so that after an impression has been given on one side by one of the main cylinders, the other side may receive an impression by passing round the other main cylinder. When the sheet arrives at the bottom of the first main cylinder it comes into contact with the form of types lying upon the carriage. The sheet having thus received an impression, and being still held between the two systems of tapes, is carried upwards over the first intermediate cylinder, then under the second intermediate cylinder, and over a considerable portion of the upper part of the second main cylinder, proceeding round and under which it receives an impression from the second form seen to the left, about to pass under this cylinder. The sheet, being now printed on both sides, must be freed by the tapes, and for this purpose the two systems separate and pursue different routes to the point where they commenced their joint action. The printed sheet is then received by an attendant boy on a table in the clear space in the centre of the machine.

The carriage on which the two forms of types are laid corresponds in office to the table of the common hand-press, being the bed or table upon which the forms of type are laid. The operation of the machine requires that it should have an alternating horizontal motion, which is obtained by mounting it upon castors or wheels that move upon

two rails or guides firmly fixed to the frame of the machine. This reciprocating motion of the carriage is effected by a pinion turning in an endless rack below, the teeth of the pinion acting on the teeth of the upper part of the rack to drive it forward, and again on the teeth of the under part to cause it to return. This part of the apparatus cannot be represented in the engraving, but this is of the less consequence, as it is a contrivance well known to every mechanic as being one of the simplest and most effective methods of converting a continuous circular motion into a rectilinear alternating one. The rack apparatus is connected to the carriage by a simple arrangement of levers. The carriage thus moving alternately backwards and forwards carries the two forms of types (which are securely fixed upon it at a proper distance) alternately under the main cylinders, which give the impression. The adjustment of the two forms upon the carriage must be properly made, otherwise the register will be destroyed. It should be noted that about one-half of the diameter of each of the main cylinders is reduced about half an inch to allow of the free return of the type-form, which otherwise would print both going and coming.

By no means the least important or least ingenious department of the printing machine is the apparatus for furnishing and distributing the ink, performed by means of rollers covered with the elastic composition of glycerine and glue formerly mentioned, of which there is a set at each end of the machine, corresponding with the two tables and the two forms of types. From the ink duct at either extremity of the machine, in which a metal roller is continually revolving, a vibrating roller delivers on a table a regulated quantity of ink each time it arrives at either end of the machine. This ink is distributed upon the table by means of rollers which are moved wholly by friction, and is taken from the table and delivered to the types by the furnishing rollers, close to the main cylinders, each time the form of types passes under them. Machines such as the one described will throw off 1000 to 1200 sheets per hour, printed upon both sides.

Several improved perfecting machines have been invented. In some, no tapes are used; instead of them, a set of metal fingers in a longitudinal opening in the first cylinder open and grasp the sheet held out for them by the attendant on the left; and they, after the sheet has been printed on the one side, open and deliver it to a similar set of grippers on the second cylinder; which again, when it is perfected or printed on the second side, open and throw it to the attendant on the right. In others, appliances called 'flyers' are added, whereby the printed sheets are automatically discharged, thus dispensing with the workman who was required to take off. Other improvements have been introduced the value of which would only be understood by experts.

Machines on a plan similar to the perfecting arrangement just described are constructed for newspapers of the smaller size and moderate circulation. They are made with two or four cylinders, each of which prints a copy of one side of a paper at each travel of the type-table, two or four boys being employed to feed simultaneously. In this way are printed 1500, 2000, or 5000 copies per hour. This process has to be repeated to print the second side.

For much book-work and for miscellaneous or jobbing work single-cylinder machines are used, printing on one side only. Two of these are illustrated. One (Plate II., fig. 1) is a 'stop-cylinder' machine, the printing cylinder of which is brought to a stand-still after each revolution, to allow of the backward traverse of the bed. The other (Plate II.,

fig. 3) is a 'two-revolution' machine, in which the cylinder makes two revolutions to the one backward-and-forward traverse of the bed. In the latter the cylinder rotates continuously in the one direction; the former rotates in both directions alternately. The first machine is of the pattern most generally known in this country as the Wharfedale, from the name of the district, in Yorkshire, in which it was first manufactured. The particular machine shown is intended for high-class and illustrated work, the construction being designed to withstand the heaviest impression. The inking arrangement is designed to obtain the finest distribution, while the method of feeding ensures perfect register. Presses of this design generally are made by several engineering firms. The type of two-revolution press shown is that of the Miehle Press, of American invention, but made by the Printing Machinery Trust, Ltd., London. The machine is capable of producing the highest class of illustrated or other work at a very much greater speed than that of the ordinary stop-cylinder machines. It permits of an immensely heavy impression while maintaining perfect rigidity when running. The ink-distributing arrangements are peculiar to it, being arranged on the pyramidal system. The rollers are four in number, arranged in two pairs, over each pair being a steel vibrating cylinder. On each rests a composition roller, and on and between these rollers another light steel roller connects the whole in a pyramid.

Platen Printing-machines.—The machines hitherto described have been of the cylinder class, and of the outcome of that class—the rotary.

The platen method, already explained in connection with the hand-press, is also used in small jobbing machines. They differ from hand-presses, however, in that the bed of the form and the platen are vertical instead of horizontal. This kind of machine was first patented by Kitchen of Newcastle in 1833, and completed by G. P. Gordon of New York in 1851, but not introduced into England until 1866. They are frequently known as Cropper machines, after the name of the firm which first made them in England. They are sometimes worked by a treadle, but more often by power; they perform the whole of the operation of printing, the attendant having simply to lay the paper to be printed to a gauge, and remove the printed sheet; in some cases automatic delivery renders even taking off unnecessary.

During recent years great improvements have been made in platen machines. The early ones were compact and simple machines, but were deficient in certain qualities now considered essential when the best kinds of modern printing are attempted. Hence the attention of press builders has been directed to securing greater strength of impression, increased inking and distributing power, more convenience in making ready, and a higher rate of output. The machine illustrated (Plate I., fig. 2) was invented by Mr. Golding of Boston, U.S.A., and called the 'Golding Jobber'. It is manufactured in Great Britain by Furnival & Co., of Reddish, Lancashire, as the 'Reddish Jobber'.

Warehousing.—The printed sheets are conveyed from the press or machine to the warehouse. Here they may be hung on long horizontal poles, and exposed to the air for some time, for the purpose of fixing the ink as well as for extracting the moisture from the paper if it has been damped. When dry they are sometimes placed singly between sheets of highly glazed pasteboard, and then subjected to very great pressure in a Bramah press, by which means any roughness consequent on the impression of the types is entirely removed, and the surface of

the paper generally smoothed down. Improved methods of press-work, by which the embossing of the paper by the type is avoided, render this process unnecessary; or the sheets may be put through a sort of calendering machine with hot rollers, for the purpose of imparting a glossy finish. The sheets are eventually counted, parcelled up, and finally handed over to the bookbinder.

Copperplate Printing.—In our article ENGRAVING a minute account has been given of the process by which subjects are engraved upon plates of copper or steel. The process of printing from them, though in some respects analogous to that of letterpress printing, yet in many essential particulars differs from it. While in letterpress printing it is the *raised* surfaces of the types which give the impression, in copperplate printing it is the hollow scooped-out lines that perform that office.

The workman having previously dampened and prepared the paper, which is of a soft fibulous texture, places the plate or engraving from which the impressions are to be taken on a small stove or heater with which he is supplied. After being sufficiently warm to assist the ink in finding its way into the fine incised lines, he daubs the whole surface of the plate with ink and boiled oil of the consistency of thick paste. The ink being well rubbed into the lines, he proceeds to clean the plate by wiping off the ink from the raised surface, taking care not to wipe any of it out of the lines, and polishing the margins with whiting. When fully ready he lays the plate upon the flat table of a rolling press, wrought by hand, and places over it the piece of paper which is to receive the impression; then, by bringing the press into action, he moves the table along between two metal rollers, thereby subjecting the plate to a sharp pressure, which throws the ink from the hollow lines on to the paper, and thus produces the impression desired. The upper metal roller is covered with several thicknesses of soft blanketing specially manufactured for this purpose. By this means the paper is forced down into the engraved parts with a firm soft pressure, and the plate itself is preserved from injury. The process of inking, &c., is repeated as already described for each impression required; consequently the operation is slow.

From a small well-engraved plate a workman will produce 500 impressions in a day. As the plate increases in size, and as the quality of the engraving is of a higher description, the number produced decreases. Many large engravings, such as those distributed by the Art Unions, cannot be produced more rapidly than four each hour, and some even still more slowly. Steam cylindrical machinery has been brought to bear upon the process of copperplate printing, but only for inferior work, and the method above mentioned continues to give the highest artistic results. Printing from steel plates, which are now generally substituted for copper plates, is done in the same way.

The process of finishing in plate-printing is exceedingly simple, consisting chiefly in placing the most printed impressions between smooth absorbent mill-boards, and subjecting them there to a slight pressure. When relieved they are examined, cleaned if necessary, and are then ready for sale.

PRINTING, LITHOGRAPHIC. See LITHOGRAPHY.

PRIOR was the title formerly given to the head of a small monastery, to which the designation of priory was applied. The prior ranked next in position to the abbot. Similarly, the term *prioress* was applied to the head of a female convent. The title of *grand prior* was given to the commandants of the grand military priories of the orders of St. John of Jerusalem, of Malta, and of the Templars.

PRIOR, MATTHEW, an English poet and diplomatist, was born on July 21, 1664, at Wimborne in Dorsetshire, or at Winburn in Middlesex, most probably the former. He was placed by his father at Westminster School, under Doctor Busby; but on his father's death his mother had to take him from school and put him in the office of an uncle who was a vintner in the metropolis. His acquaintance with Horace and Ovid, and his skill in making verse translations from them, attracted the notice of the Earl of Dorset, and ultimately he was sent again to Westminster School to continue his studies at the expense of the Earl and his uncle. In 1683 he accepted a scholarship at St. John's College, Cambridge, against the wish of Lord Dorset, who desired him to go to Oxford, and who in consequence was alienated from him for a time. He graduated as B.A. in 1686, and was shortly after (in 1688) chosen fellow. A poetical tribute to the Earl of Exeter which he composed on behalf of his college gained him a tutorship to Lord Exeter's sons, which ended with that peer's departure to Italy after the revolution. While at Westminster School he had contracted an intimacy with Charles Montagu, afterwards Earl of Halifax, in concert with whom, in 1687, he composed the Country Mouse and City Mouse—a parody on Dryden's Hind and Panther. In 1690 he was introduced at court by the Earl of Dorset, at whose recommendation he was appointed secretary to the English plenipotentiaries at the Hague. He was also gentleman of the king's bed-chamber. In 1694 he wrote a Hymn to the Sun, in the following year he presented an ode to King William, on the death of Queen Mary, and soon after displayed his humorous vein in a parody on Boileau's ode on the taking of Namur, when it was recaptured by William. He also celebrated in his easy jingle William's escape from assassination in 1696, and wrote about the same time a poem, called *The Secretary*, in which he describes something of his life in Holland. In 1697 he was nominated secretary to the commissioners who concluded the Peace of Ryswick, and on his return from that employment was made secretary to the Lord-lieutenant of Ireland. He was afterwards secretary to the Earls of Portland and Jersey, successively ambassadors to France. At length he was made under-secretary of state, and while holding that office was sent to France to assist in the partition treaty. In 1701 he entered Parliament, and in the same year succeeded Locke as a commissioner at the board of trade, but soon after joined the Tory party. At the beginning of the reign of Anne he published a volume of poems, and took some share in *The Examiner*. In 1711, when the Tories again obtained the ascendancy, he was employed in secretly negotiating at Paris the terms of the Treaty of Utrecht. He remained in France, with the appointment of ambassador, and after the departure of the Duke of Shrewsbury, in 1713, publicly assumed that character. On the accession of George I., in the following year, when the Whigs were once more in power, Prior was recalled and examined before the privy-council in respect to his share in negotiating the Treaty of Utrecht, and treated with great rigour, being kept in custody on a charge of high treason for two years, although ultimately discharged without trial. Being without any provision for his declining years, except his fellowship, he again applied himself to poetry; and having finished his *Solomon*, he published his poems by subscription. The publication, being liberally encouraged by party zeal, produced a considerable sum, which was doubled by the Earl of Oxford, at whose seat the author died, after a lingering illness, in 1721, in the fifty-eighth year of his age. He was interred

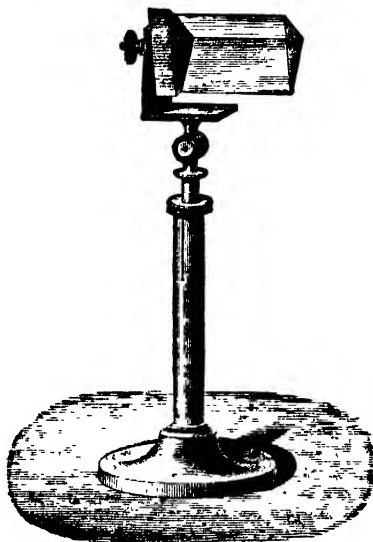
in Westminster Abbey, under a monument, for which 'last piece of human vanity,' as he styles it in his will, he left the sum of £500. Prior seems to have made his way by wit and social qualities, rather than by moral or political endowments of a superior order. He is said to have always retained a taste for coarse intercourse and gross enjoyments. As a poet, his reputation has declined of late years, the humour in which he principally excels being overlooked on account of the character of his serious performances, which, although, as in his Solomon, and Henry and Emma, splendid and correct in diction, harmonious in versification, and copious in poetical imagery, fail in moving either the feelings or the fancy. The great art of Prior consists in telling a story with a degree of poetical ease and vivacity, which, perhaps, setting aside La Fontaine, has never been excelled. His *Alma*, a piece of philosophical pleasantry, exhibits a felicitous vein of humour; and for his lighter pieces he is now chiefly read. A History of the Transactions of his Own Times, compiled from his MSS., contains little from his pen, and is of small value. The most complete edition of his works is the Aldine (2 vols. 1892). There is a good selection, with introduction and notes, by Austin Dobson (1889).

PRISCIANUS, a celebrated Roman grammarian, who lived in the latter half of the fifth century of our era, and of whom little more is known than that he was born at Cæsarea, taught grammar at Constantinople in the time of Justinian, and wrote various works, of which several are still extant. Profoundly conversant with the Latin and Greek languages, as well as with the investigations of previous grammarians, he was enabled to enter better than his predecessors into the grammatical peculiarities of the Latin tongue. He arranged his observations upon this subject in a work entitled *Commentariorum grammaticorum lib. xvii.* This work, successively abridged by several writers, formed the basis of instruction in Latin up to the fifteenth century. It contains numerous quotations from Latin authors now lost. It is the best treatise on the subject bequeathed to us by antiquity, and it furnished the materials for most of the Latin grammars compiled at the revival of letters, has gone through many editions, and may still be consulted with profit.

PRISCILLIAN, the founder of a Gnostic sect in Spain, known as Priscillianists, in the middle of the fourth century, gained over by his eloquence even some bishops to his system, compounded of dualism, the theory of emanations, and astrology, and resembling very much the doctrine of the Manicheans. He taught that the soul was of the same substance as God, and admitted an evil principle as author of the world, without, however, rejecting the Old Testament, which he interpreted allegorically. He was excommunicated by a synod at Cæsar-Augusta (Saragossa) in 380, but managed, by means of bribery, to get the decision reversed, and obliged his chief enemy, Bishop Ithacius, of Ososnuba, to take flight. The bishop, however, succeeded in gaining over Maximus, the usurper at Treves, to his side, and thus obtained the condemnation of the Priscillianists, as well as of their leader, who, in spite of an appeal to Maximus, was executed at Treves in 385. This is said to have been the first instance in which a heretic was punished with death, and was protested against by Martin of Tours, Ambrose, and other bishops. In recent years several scholars have sought to rehabilitate the memory of the Priscillianists. See, for instance, Paret's *Priscillian, ein Reformator des vierten Jahrhunderts* (1891).

PRISM, in geometry, a solid figure which might be generated by the motion of a line kept parallel to itself, one extremity of it being carried round a

rectilinear figure. A 'right prism' is a solid figure bounded by two parallel equal and similar ends, and by a number of plane faces which are at right angles to the ends. In optics a prism is any portion of a medium lying between two plane faces which are not parallel. Prisms of glass are always true geometrical prisms, their sections being triangles, either right-angled, equilateral, or isosceles. The two latter kinds are usually employed in the prismatic decomposition of light. The right-angled prism is used as



a reflector. The figure shows a glass prism mounted in the usual way on a stand which has three joints. We have also 'prismatic lenses,' 'double-image prism,' 'Nichol's prism,' 'inverting prism,' 'liquid prisms' of various kinds, &c.

PRISON DISCIPLINE. The true and only real object of punishment is the prevention of crime. There is, of course, a great latitude of choice in the means which may be adopted for the attainment of this object—a latitude to be limited by a just regard to the rights inseparable from human nature, however depraved, by a correct view of the true power of society over its members, and by a wise estimate of the probable effect of the means employed. In most ages of the world men seem to have imagined their rightful power over their fellowmen absolutely unlimited, and have inflicted punishment upon the violators of the law apparently without regard to any other consideration than their own pleasure, and the degree of guilt they have attributed to the offender. Acting with this apprehension of their own unrestricted power, they have, at the same time, exhibited the most narrow acquaintance with the almost infinite variety of means of punishment. They have confined themselves very much to the effects of physical suffering, as if that were the sole remedy which could be advantageously applied to moral depravity; a depravity often increased, if not caused, by the temptations to which physical suffering has itself exposed men. It has happened too, in this, as in so many other human pursuits, that the end has been forgotten in attention to the means; and the object has appeared to be rather secretly to harass and oppress the subjects of punishment, than either to deter others from the commission of crime, or to amend the habits of the guilty themselves. None would be prevented from the commission of

crime by penalties which were unknown, and in the extreme depression of every physical and mental quality, it were absurd to expect any reformation of the unfortunate subjects of human severity. In all ages and nations of which we have any record, from the most refined people of ancient times to the most civilized of a more modern era, have such extremes of severity been used in the punishment of criminals as justly to deserve the appellation of *cruelty*. Torture in every horrible variety; chains, stripes; solitary confinement in darkness, dampness, and idleness; promiscuous crowding of offenders of every degree of guilt in the same loathsome, pestilential, narrow vaults; insufficient and unwholesome food; filth; illness of the body, and sickness of the soul—are some of the evils which have, in every age, been wantonly, carelessly, or ignorantly inflicted upon the violators of law; and what is worse, they have been inflicted upon those who have violated no law; upon many who have been proved innocent after suffering the infliction of some or all of the ills enumerated in this atrocious catalogue, and upon many whose imprudence alone has exposed them to the vengeance of an equally imprudent creditor. How long such evils may go on without exciting interest among people at large is strikingly illustrated in the universal outcry of horror and indignation which at last was heard throughout the civilized world when Howard disclosed the misery everywhere suffered by the prisoner. From the year 1777, when Howard's work on the state of the prisons in England and Wales was first published, may be dated the origin of the study of the best system of prison discipline. There were, indeed, previous noble examples of attention to those who were sick and in prison, but it then became a subject of general interest. The names of Carlo Borromeo, Claudius Bernard, and St. Vincent de Paul ought never to be forgotten among those who have shown mercy to the captive. But Howard deserves still greater veneration for his persevering philanthropy and entire devotion to his noble object. The sphere of his exertions was not limited to his immediate neighbourhood, but extended first throughout his native land, afterwards to adjoining kingdoms, and embraced at length the whole of Europe.

As an immediate result of Howard's exertions, parliament entrusted a committee of three (of whom Howard was one) with the duty of framing a suitable scheme for the future management of the prisons. Their recommendations were embodied in the Act 19, Geo. III. c. 74 (1779), which sets forth distinctly the principles that were to govern future prison discipline in Britain. The chief features emphasized are—solitary confinement, cleanliness, medical help, regular work, and the enforcement of order—the same principles, indeed, which are now adopted by every civilized state in the world. Up almost to this time many criminals had been sent as convicts to America; but this being no longer possible, the new scheme was intended to provide accommodation for such at home. Australia, however, now presented itself as a new field for transportation, and the legislature hailed with joy this new receptacle for criminals, though only a certain number could be so disposed of. Another expedient adopted for the treatment of prisoners was confinement in hulks in the Thames or elsewhere, and a certain number continued to be kept in these for a considerable period. The new-born zeal of the public evidenced in the act of 1779 was not long in dying out, and the new scheme for amendment of prison discipline dropped for eleven years, to be revived again by the earnest enthusiasm of a single individual. In 1791 Bentham published a work, in which he constructed (on paper)

a model prison, which he called the Panopticon. Next year he proposed himself to construct the building in reality. His ideal prison was not unlike one that Howard had proposed; but Bentham trusted greatly to publicity and free communication between criminals and the public for the protection of the inmates from oppression. In 1794 the government adopted his scheme, but the construction of the prison was put off till 1810, when Sir Samuel Romilly moved parliament to take up the matter once more. This time it was pushed to a successful issue; and in 1811 was erected the famous penitentiary of Millbank, virtually on Howard's plans, and destined to be the precursor of the modern prison. This was only the beginning of reform, and the credit of carrying it on is largely due to the Prison Discipline Society, and to Mr. Buxton and Mrs. Fry, its leading members. The latter began her work at Newgate in 1818, and found that prison in a state as bad as can be imagined. Among the prisoners themselves she effected a reformation, perhaps only temporary; but among the public her efforts inaugurated a desire for improvement which resulted in the abolition of all such scandals. In 1824 and 1826 the legislature passed important acts for the regulation of prisons, containing provisions for moral and sanitary care of prisoners, separation of the sexes, &c. The use of irons was partially forbidden, and separate cells for each prisoner recommended. These laws, though not carried out to the letter at first, were very helpful to future reformers. In 1831 a committee of the House of Commons reported in favour of separate cells in all cases, and this suggestion was adopted. The gradual work of modernizing prisons then went on until the cessation of transportation to New South Wales in 1840 (followed in subsequent years by its cessation to all the other colonies) and the general defects of this system rendered it necessary to look out for new ways of disposing of the criminal population. The chief features of a new scheme now brought into operation consisted of the following: (1) Separate confinement in a penitentiary for a short period; (2) hard prison labour in some public work; and (3) transportation with ticket-of-leave. For the first of these forms of punishment the existing prisons were used; for the second, which really came in place of the former system of wholesale transportation, public work was found at Portland, Dartmoor, and Portsmouth. The third was not successful. The colonies refused to receive the ticket-of-leave men, and these had ultimately to be liberated at home. An important act subsequently passed, the Prisons Act 1865, consolidated the law regarding prisons and their inmates, and enacted that debtors were to be kept separate from other prisoners, that females were to be kept, if possible, in separate prisons from males, that criminal prisoners were to be kept in separate cells, and made many minute regulations regarding the treatment of prisoners and management of prisons. By this act also persons convicted of misdemeanour, and sentenced to imprisonment without hard labour, were not to be considered criminals, and were to have special treatment and privileges. Entire uniformity in the management of prisons was secured in 1878 when all prisons were removed from the control of local authorities and put directly under government.

At the time when Howard was devoting himself to the amelioration of the evils of imprisonment, the Society of Friends in Philadelphia, acting on the principles of the wise and benevolent founder of their sect, were endeavouring to abolish the use of some of the cruel and injudicious modes of punishment then practised (such as the pillory, the scourge, &c.), and

to substitute for them, as well as for capital punishment, the milder and, as they believed it would prove, more efficacious measure of solitary imprisonment without occupation or intercourse with any person. In pursuance of this scheme the celebrated prison at Auburn, in the state of New York, was built. The solitary system of imprisonment was here carried out with the utmost rigour. The prisoner was never allowed for a moment to quit the cell, to hold intercourse with anyone, or even to see the attendant warder. This system had to be abandoned, however, owing to the disastrous consequences which in many instances ensued. The health of the prisoners was frequently irreparably injured, and insanity supervened in many cases. The solitary system having thus, in a great measure, proved a failure in America, the second great experiment in prison discipline—the silent system—was instituted. The principal establishment where this system was carried out to its utmost extent was the penitentiary of Sing Sing in the state of New York. The prisoners were still, as at Auburn, confined to separate cells during the night, but in the daytime were conducted out to large rooms where they worked together, but without being allowed to exchange a single word, or so much as a single glance, with any of their companions. Throughout the whole period that they worked together in their common compartment, as well as during and after their return to their cells, this system of sepulchral silence was rigidly maintained. Any transgression of these rules was followed by the immediate infliction of corporal punishment in the shape of whipping, and this penalty was equally incurred by the prisoner speaking to one of his fellow-prisoners, or to a stranger visiting the prison. To ensure the efficacy and promptitude of the punishment, the humblest officer in charge of the prisoners had necessarily to be intrusted with the power of administering it, and such an irresponsible authority must doubtless, in many instances, have been liable to be grossly abused. It has also been argued that the restraints imposed under the silent system must, in the end, prove as injurious to the minds of those subjected to it as the consequences resulting from isolated confinement under the solitary system. But perhaps one of the most effectual arguments against the silent method is to be found in the fact, that even under the most rigid restraint, it was found impossible to prevent the prisoners exchanging communications with each other by means of signs. This circumstance was strikingly evinced by the discovery of the acquaintance of the prisoners with facts supposed to be quite beyond their possible knowledge—so impossible is it effectually to debar men by restrictive enactments from the exercise of any faculty or the indulgence of any propensity to which they are prompted by the instincts of their nature. From a consciousness of its comparative inefficacy the silent system has in consequence undergone a considerable modification in American prisons.

The third great improvement in prison discipline—the labour system—is what is now generally pursued in Great Britain, with the combination, in certain cases, of the separate system. Nothing could be more demoralizing than the old system of imprisonment, under which numbers of men were herded together, it might be for months, without occupation of any kind, and exposed to all the corrupting influences of so promiscuous and degraded a society. A man subjected to such evil communications emerged from prison at the term of his sentence a hardened criminal, with all good aspirations and intentions of reform, which he might otherwise have cherished, completely extinguished. It has accordingly been the object of modern legislators to keep the prisoners actively

employed, both for the beneficial results, morally and physically, to the parties occupied, and also with the view of rendering prisoners to a certain extent self-supporting, by the value obtained from the produce of their labour. The latter purpose has more especially been followed out in continental prisons, but neither there nor in Britain can its success be said to have been very great. In the latter country, indeed, the view taken of prison labour is not so much that of an expedient by which the debt incurred by the prisoner to society may be liquidated, but as a system of penal exertion to act as a warning in deterring others from the commission of crime. The first experiment in the last-mentioned direction was the institution of the tread-mill, which consists of a huge cylindrical wheel, turned by the treading of the prisoners. A strong objection to this mode of punishment was the fact that an equal degree of labour was thus apportioned to each prisoner, without any regard to the diversities in the amount of personal strength possessed by each. It has accordingly in many penitentiaries been superseded by the crank, which consists of a wheel kept in motion by the turning of a handle, and which may or may not be utilized in the production of some useful result. The labour of the prisoner can easily be regulated according to his strength, the number of turns he gives the wheel being shown by a dial. At present the system of imprisonment in Britain stands thus: When the convict is sentenced for a period of two years or less, the punishment is technically termed *imprisonment*. The criminal passes the time in a local prison, where he lives in solitary confinement and works at the tread-wheel or crank for a month; if his conduct is good he receives marks which entitle him to improved conditions as the close of his term approaches. *Penal servitude* is the title applied to terms of imprisonment which exceed two years. It is passed in a convict prison, and is divided into three periods. The first lasts nine months, is one of solitary confinement, and during it the convict is set to work at some industry. The second period is also distinguished by cellular isolation, but the convict works along with others under the supervision of warders at one of the great convict prisons such as Portland or Dartmoor, where their labour results to the public advantage. The final period is that of release on ticket-of-leave, during which the convict is obliged to report himself at intervals to the police, and is generally under strict supervision.

PRISONERS OF WAR are persons captured from the enemy in time of war. In ancient times prisoners of war became the slaves of their captors, and even yet it is a recognized principle among nations that all the inhabitants of a vanquished town, state, or nation become the absolute property of the victors; though it is no longer acted upon by civilized nations. When a hostile army enters a country non-combatants are usually left unmolested, so far at least as their personal liberty is concerned. The combatants who have laid down their arms become prisoners of war, and their persons are at the entire disposal of the conquerors. The practice is to keep them in confinement till the termination of the war, or until a mutual exchange of prisoners between the warring states gives them their liberty. They are commonly treated in a somewhat similar manner to ordinary prisoners, only they are not generally subjected to penal labour. (See **PAROLE**.) In 1811 about 50,000 Frenchmen were prisoners of war in England, while about 10,000 English were in French prisons.

PRISREND, or **PERSERIM**, a town of European Turkey, in Albania, on the right bank of the Rieksa, 4 or 5 miles from its confluence with the Drin. It is the residence of a pasha, and the seat of a Greek

metropolitan and a Catholic bishop. Among its buildings it numbers forty-two mosques, one Catholic and five Greek churches. It has considerable manufactures of fire-arms, which are much celebrated; and a large traffic with the adjacent country, and with many of the large towns in Albania, Roumelia, and Servia. Pop. about 39,000.

PRISTINA, or **PRISTINA**, a town of Turkey in Europe, about 100 miles north-east of Scutari. It is the residence of a pasha, and the see of a Greek bishop; and contains a number of handsome mosques, bazaars, baths, and other buildings. Pop. 10,000.

PRITZWALK, a town in Prussia, in the government and 66 miles north-west of Berlin, on the left bank of the Domnitz. It is an old town and has a Protestant church, hospital; manufactures of woollen and linen cloth, a tobacco-factory, and a brewery. Pop. (1890), 6359.

PRIVAS (Latin, *Privatum Castrum*), a town in France, capital of the department Ardèche, at the junction of three small streams, and inclosed by an amphitheatre, of rugged and arid hills, 21 miles south-west of Valence. It has a prefecture, with a fine park adjoining; courthouse, hospital, and prison; a court of first resort, an agricultural society, and a communal college; manufactures of blankets and other woollen stuffs, silk thread and yarn, leather, and brandy; and a trade in silk, cattle, leather, coals, &c. It was once a place of great strength and importance, and a kind of rallying-point for Protestantism. Its inhabitants were butchered, its houses burned, and its fortifications razed in 1629; the leader in this atrocity being Louis XIII. Pop. (1890), 7312.

PRIVATEER, a vessel of war owned and equipped by private individuals to seize or plunder the ships of an enemy. Such a vessel must be licensed by government and under a letter of marque, otherwise she is a pirate. The first check to the practice of private plundering upon sea, so universal in earlier times, was by confining the right to those who received letters of marque or of reprisals. These were issued upon the petition of a subject who complained of injustice done him by some foreign prince or subject, and they empowered the party to obtain satisfaction by seizing the goods of any subject of the offending state. It does not seem to have been considered necessary to be provided with letters of reprisals till the fourteenth century, and no mention is made of them in treaties prior to that time. The practice of granting commissions to privateers did not become general before the end of the sixteenth century. The first instance in which their aid appears to have been considered important in carrying on war was in the contest between Spain and her revolted provinces of the Low Countries, which began in 1569. In 1570 the Prince of Orange, in the hope of replenishing his impoverished finances by seizing on the money sent from Spain to the Netherlands, issued commissions to many of his adherents authorizing them to cruise against the ships of Spain. A considerable fleet was equipped, and increasing daily in numbers they soon became terrible by their depredations, not only on the commerce of Spain and the Netherlands, but on that of their own and other countries. The French, however, were probably the first to send out in considerable numbers these scourges of the sea. Their code exhibits the most ancient regulations concerning privateers, and their maritime laws have always been the most severe against the commerce of neutrals. In 1555 the people of Dieppe fitted out nineteen ships and six brigantines, in consequence of having received a commission to attack several Dutch ships of great burden returning from Spain. Spain and England, shortly after the depredations committed under the

commissions of the Prince of Orange, issued commissions to great numbers of privateers. The expeditions of Drake and Frobiisher are said to have been of this nature. The Dutch war for independence, which began in 1669, did not end till 1648. In that long contest the use of privateers became familiar, and remained so for a long time in all wars between maritime countries. English and French privateers were common and did immense damage to shipping during the long war period of 1793-1814. In 1785, by a treaty concluded between the United States of America and Prussia, it was provided that neither of the contracting powers should grant or issue any commission to any private armed vessels empowering them to take or destroy trading vessels. The United States employed privateers against British vessels in the war of independence, and again in 1812; and refused to join the European powers which agreed mutually to abolish privateering in 1856.

PRIVET (*Ligustrum*), a genus of plants of the natural order Oleaceæ, which includes also the olive, ash, and lilac. The calyx is short, tubular, and four-toothed; the corolla funnel-shaped, four-partite; the stamens, two in number, are seated on the tube of the corolla, and the style is very short; the flowers are small, white, and disposed in terminal panicles; shrubs with opposite leaves; berries usually small and globular. The Common Privet (*L. vulgare*) is a native of Europe, common in hedges and woods; the leaves are elliptico-lanceolate, entire, and smooth; the flowers slightly odorous, white at first but soon changing to a reddish-brown; and the berries dark purple, approaching black. This species is much used in gardens for ornamental hedges and for shelter. The wood is hard, and used by turners and shoemakers for pegs. A rose-coloured pigment is obtained from the pulp of the berries, which are also used, with the addition of alum, to dye wool and silk of a durable green. The berries remain upon the shrubs till spring.

PRIVILEGE (Latin, *privilegium* = *privata lex*, a private law), a particular beneficial exemption from the general rules of law. This exemption may be either *real* or *personal*; real, when it attaches to any place; personal, when it attaches to persons, as ambassadors, members of Parliament, clergymen, lawyers, and others. Formerly religious houses and certain localities conferred the privilege of freedom from arrest upon those entering them, and more recently many places existed which privileged those within them from arrest in civil suits. These now no longer exist. At present, however, no arrest can be made in the royal presence, nor within the verge of the Palace of Westminster, nor at any place where the sovereign resides, or the judges are judicially sitting. Exemption from arrest is guaranteed to all suitors, counsel, or other persons attending any court of record upon business; or to an arbiter under a rule of *nisi prius*.

PRIVY-CHAMBER, **GENTLEMEN OF THE**. Officers of the royal household of England, instituted by Henry VII. Their duties are to attend the sovereign; but their appointment is now honorary, no services being required of them, nor salary or fee granted. There are also four gentlemen ushers of the privy-chamber, whose office is to wait in the presence chamber, attend on the sovereign's person, and note affairs under the lord-chamberlain and vice-chamberlain.

PRIVY-COUNCIL (*consilium regis*, *privatum consilium*), a council of state held by the British sovereign and councillors, to concert matters for the public service, and for the honour and safety of the realm. Until the rise of the cabinet the most responsible and influential advisers of the crown in state affairs were the members of the privy-council.

The number of privy-councillors is indefinite; they are nominated by the sovereign at pleasure, and no patent or grant is necessary, but they must be natural-born subjects. The list of privy-councillors now embraces, besides the members of the royal family and the members of the cabinet, the Archbishops of Canterbury and York, the Bishop of London, the great officers of state, the lord-chancellor, the lord chief justice, the lords justices of the court of appeal, the president of the probate, divorce, and admiralty division, the law officers of the crown, some of the Scottish judges, the speaker of the House of Commons, the ambassadors, some of the ministers plenipotentiary and governors of colonies, the commander-in-chief, the master-general of the ordnance, the first lord of the admiralty; and sometimes other persons who fill or have filled responsible offices under the crown. In 1897 all the premiers of the self-governing colonies who officially attended the celebration of Queen Victoria's diamond jubilee in London were sworn of the privy-council. It is only on very extraordinary occasions that all the members attend the council, and it is not now usual for any member to attend unless specially summoned. The attendance of at least six members is necessary to constitute a council. The council is summoned on a notice of forty-four hours, and is never held without the presence of a secretary of state; the junior councillor delivers his opinion first, and the sovereign when present last. Formerly it was dissolved by the death of the sovereign; but by 6 Anne, cap. vii., it is not dissolved till six months after the demise of the crown, unless sooner determined by the successor. Privy-councillors are by their oath bound to advise the crown without partiality, affection, or dread; to keep its counsel secret, to avoid corruption, and to assist in the execution of what is resolved upon. The powers and functions of the privy-council, either in its special forms or as a whole, are very varied, but some of them are more theoretical than practical. Several important departments of the executive government either have been or still are committees of the council. Thus the Cabinet, which forms so prominent a feature in the present parliamentary system, is theoretically a committee of the privy-council, and the Board of Trade, though now regarded as a distinct department of state under its own president, has been from the first strictly a committee of the council charged with the control of a special class of affairs. The Local Government Board does not occupy the technical position of a committee, but it had a precisely similar origin, and the same may be said of the more recently created Board of Agriculture. The Committee of Council on Education was formally replaced by a Board of Education in 1900 (see next article), but the educational system of Scotland is still controlled by a body which is technically a committee of the council. The granting of charters under the Municipal Corporations Act, the registration of practitioners under the medical and similar acts, and other such functions, are also vested in the privy-council; and special committees of the council are charged with the regulation of the universities of Scotland and of England. The judicial committee of the council has an extensive jurisdiction in appeals from various civil and ecclesiastical courts. It was created as a permanent court by the statute 3 and 4 Will. IV. cap. xli., and includes the lord-president of the council, the lord-chancellor, the lords justices, and other legal members of the council. This committee is a supreme court of appeal for many colonial cases, mostly civil, but partly also criminal. The act 34 and 35 Vict. cap. xci. provided for the addition of paid justices; but the Appellate Jurisdiction Act

of 1876 introduced regulations which will in time have the effect of uniting in one body the judicial powers of the privy-council and the House of Lords. The judicial committee has jurisdiction under the Church Discipline and Public Worship Acts, and in such cases provision is made for the attendance of archbishops and bishops. The original jurisdiction of this committee is of much less importance than its appellate jurisdiction, and has reference chiefly to patents, copyright, and other similar matters. The official head of the council is the lord-president, who is appointed by patent. All privy-councillors are styled 'right honourable'. Formerly a privy-councillor enjoyed certain privileges in respect of personal security, but these were abolished in 1828.

The privy-council is of great antiquity. It may be traced back to the *curia regis* of the Norman kings, which was itself a branch or committee of the great or common council (*concilium commune* or *magnum*) of the realm. The curia gradually gave rise to the courts of king's bench, common pleas, &c., and this narrowing of its jurisdiction led to certain changes in its character, whose completion is marked by the general adoption of the name of ordinary council (*concilium ordinarium*) about the time of Edward I. This ordinary council assumed the name of privy-council during the fifteenth century, and in 1640 the Long Parliament deprived it of many of its arbitrary and insufficiently defined powers. Under the Tudors and the first two Stuart sovereigns the great powers of the council, legislative, administrative, and judicial, were used to the utmost in the interests of the crown; but from the Restoration to the present time this ancient body has gradually retired more and more into the background of national politics. In 1679 Sir William Temple made a noteworthy but entirely unsuccessful attempt to reorganize the council so as to adapt it to the needs of that critical time. He proposed that it should consist of fifteen great officers of the crown and fifteen others chosen with reference to wealth and social position, and that the king should act only in accordance with its advice. Now, however, the portion of the privy-council known as the cabinet is the most important branch of the government, forming in fact the executive government of the kingdom. In Scotland the privy-council consisted of persons chosen by the king to advise with in matters of government and police; but by an act of Anne the Scotch privy-council was absorbed in the British privy-council, which is by that act declared to have no other or higher powers than were possessed by the English privy-council at the time of the Union. Ireland has a separate privy-council, smaller than that of Great Britain, which exercises somewhat similar powers in relation to Irish affairs. In 1900 the privy-council of Great Britain consisted of some 220 members, of whom almost exactly one-half were peers. The Irish council comprised 60 members, of whom about one-third were peers.

Orders in council are orders issued by the sovereign, by and with the advice of the privy-council, either by virtue of the royal prerogative, and independently of any act of Parliament, or by virtue of such act, authorizing the sovereign in council to modify or dispense with certain statutory provisions which it may be deemed expedient in particular conjunctures to alter or suspend. When a permission is to be given to a particular individual, it is usual to grant it by licence; but orders in council are of a more general nature, and contain dispensations or prohibitions extending to a whole branch of commerce.

PRIVY-COUNCIL, COMMITTEE OF, ON EDUCATION, a committee appointed in Britain in 1839 for administering the grants which it had been the

practice of the government to make for some time previously, with a view to meet the educational wants of the country. Since the passing of the Education Acts of 1870 and 1872, for England and Scotland respectively, primary public education in these two countries has been mainly regulated by these acts (see BRITAIN—Education). By the Board of Education Act of 1899, which came into operation on April 1, 1900, the direction of education in England and Wales was entrusted to a board, consisting of a president, the lord-president of the council, the principal secretaries of state, the first lord of the treasury, and the chancellor of the exchequer. This board took the place of the former Education Department or Committee of Council (including the Department of Science and Art), and to it the king in council may transfer any of the educational powers of the Charity Commissioners or of the Board of Agriculture. This board is assisted by a consultative committee representing expert educational opinion. The president of the board is appointed by the king and holds office during his pleasure. The Education Department for Scotland was not superseded by this act, and is still a committee of council.

PRIVY-PURSE, KEEPER OF THE, an officer of the royal household of Great Britain, whose function it is to take charge of the payment of the private expenses, including charities, of the sovereign. He has no control over any official or household expenses, and is independent of the great officers of the household.

PRIVY-SEAL (*privatum sigillum*), a seal appended by the British sovereign to such grants or things as are afterwards to pass the great seal; and sometimes used in things of less consequence, which do not require to pass the great seal, as to discharge a recognizance, debt, &c.; but no writ which relates to the common law can pass the privy-seal. Since the time of Henry VIII. the privy-seal has been the warrant of the legality of grants from the crown, and the authority for the lord-chancellor to affix the great seal. Such grants are termed letters-patent. The officer who has the custody of the privy-seal was anciently called clerk of the privy seal, afterwards guardian *del* privy-seal, and now he is called lord privy-seal, and is the fifth great officer of state, having also generally a seat in the cabinet. The lord privy-seal must not put the seal to any grant without good warrant; nor with warrant if it be against the law or inconvenient without first acquainting the sovereign therewith. By the Act 11 and 12 Vict. cap. lxxxii. (1848) it was provided that warrants under the royal sign-manual, prepared by the attorney-general and solicitor-general, setting forth the tenor and effect of the letters-patent to be granted, addressed to the lord-chancellor, and counter-signed by one of the principal secretaries of state, should be a sufficient authority for the privy-seal being affixed; and that the sign-manual so signed, counter-signed, and sealed, should be sufficient warrant to the lord-chancellor to pass letters-patent under the great seal. In Scotland the privy-seal is used in authenticating royal grants of assignable or personal rights.

PRIZE. By the term prize is generally understood anything captured in virtue of the rights of war (*jure belli*). Property captured on land is usually called *booty*, and is generally disposed of at once by the commanding general, or reserved for the disposal of his sovereign, who is accustomed to bestow and distribute it according to his discretion. In Britain by 3 and 4 Vict. cap. lxxv. the jurisdiction in matters of booty of war is vested in the judge of the prize court (who is also judge of the admiralty court) on a reference by the sovereign; otherwise it is regu-

lated by 2 and 3 Will. IV. cap. liii., which enacts that all captures shall be disposed of as the crown shall direct. Deserters entitled to prize-money do not receive any, and a certified list of the persons entitled to share in captures must be transmitted to Chelsea Hospital by the commanding officer. In some cases the prize money is paid after the soldier's decease without probate or administration. In regard to maritime captures a very different course has been pursued by all nations in modern times from that which obtains in cases of captures on land. The right of belligerents to capture the property of their enemies on the sea is admitted, as well as the right to prevent any frauds or violations of the law of nations on the part of neutrals. But these rights are limited, and must be so exercised as not to intr trench upon the independence or rights of other nations. It is accordingly settled as a principle of the law of nations that every belligerent has a right to establish tribunals of prize, to examine into all maritime captures, and to decide judicially upon their validity; and likewise that the courts of prize of the captors have exclusive jurisdiction over all matters relating to captures made under the authority of their sovereign, and the courts of other nations have no jurisdiction or authority to inquire into, or to adjudicate upon them. The sentence of a court of competent jurisdiction once pronounced is conclusive and binding on all nations. Questions of naval prize-money in England are adjudicated by the courts of admiralty. The 27 and 28 Vict. cap. xxv. (1864), enacts permanently with amendments, such provisions concerning naval prize as had previously been usually passed at the beginning of a war. Every ship taken as prize, and without breaking of bulk, must in terms of this act be delivered up to the marshal of the court, and the captors must bring the ship's papers into the registry of the court; these provisions do not apply, however, to ships of war taken as prize. If the court decide that the capture is a legal one, the prize is then sold, and the proceeds are divided amongst the captors, both officers and men, in proportions varying according to the rank of each. If the prize be a ship of war the state grants a certain sum or allowance, which allowance is distributed in the same manner.

PRIZE COURT, an English tribunal existing only by special commission under the great seal during war, and as long as the litigations connected with it continue. This court, besides adjudicating upon questions relating to captures, prize, and booty, also adjudicates upon questions of international law. There is an appeal from this court to the king in council. The judge in the court of admiralty presides in the prize court.

PROA, a peculiar kind of sailing-boat used by the natives and also the pirates of the Eastern Archipelago. It is strangely shaped, having one side quite flat, on a line with the stem and stern, while the other side is curved in the usual way. In order to keep it from upsetting, in consequence of this peculiarity in its formation, a frame carrying a weight is placed to windward, and this balances the boat when under sail. It carries a kind of lug-sail, and is equally sharp at stem and stern, so as to sail either way without turning. The usual dimensions of the proa are about 30 feet long by 3 feet wide.

PROBABILISTS, those philosophers who maintain that certainty is impossible, and that we must be satisfied with what is probable. This was the doctrine of the New Academy, particularly of Arcesilaus and Carneades. The last-mentioned philosopher distinguished three principal degrees of probability, according as a representation might be probable when considered by itself alone; probable and unim-

peached when compared with others; or thirdly, probable unimpeached and in all respects confirmed. In morals probabilists are those who teach that in our actions we must follow what seems to us most probably right, because in questions of morality demonstrative certainty is not to be attained. Among the Jesuits there were some who taught that a man may follow what is probably right, or what has been decided to be so by teachers of authority, although it may not be the most probably right, or may not seem probable to himself. It is this view that Pascal in his famous Provincial Letters holds up to ridicule. See JESUITS.

PROBABILITY, in algebra, the mathematical investigation of chances. If an event may happen in a ways and fail in b ways, and all these ways are equally likely to occur, the probability of its happen-

ing is $\frac{a}{a+b}$, and the probability of its failing is $\frac{b}{a+b}$. This is the definition of probability given in

mathematical treatises. It is evident that as 'certainty' may be represented by unity, if the probability of an event's happening is p , the probability of its failing is $1-p$. When the probability of the happening of an event is to the probability of its failing as a to b , the fact is expressed in popular language thus—the 'odds' are a to b for the event, or b to a against the event. If there are three events such that one must happen, and only one can happen, and suppose the first event can happen in a ways, the second in b ways, and the third in c ways, and that all these ways are equally likely to occur, then it is evident that the probability of the happening

of the first event is $\frac{a}{a+b+c}$, and of its failing $\frac{b+c}{a+b+c}$. Example: Suppose that 3 white balls,

4 black balls, and 5 red balls are thrown promiscuously into a bag, and a person draws out one of them; the probability that this will be white is $\frac{3}{12}$ or $\frac{1}{4}$, the probability that it will be black is $\frac{4}{12}$ or $\frac{1}{3}$, the probability that it will be red is $\frac{5}{12}$. But suppose two balls to be drawn out. The number of pairs that can be formed out of 12 things (see PERMUTATIONS AND COMBINATIONS) is 66; the number of pairs that can be formed out of 3 white balls is 3, and therefore the probability of drawing two white balls is $\frac{3}{66}$ or $\frac{1}{22}$. Similarly, the probability of drawing two black balls is $\frac{6}{66}$ or $\frac{1}{11}$; two red balls, $\frac{10}{66}$ or $\frac{5}{33}$; a white and a black, $\frac{12}{66}$ or $\frac{2}{11}$; a black and a red, $\frac{20}{66}$ or $\frac{10}{33}$; a red and a white, $\frac{20}{66}$ or $\frac{10}{33}$. The sum of these six probabilities is unity. The probability of two independent events both taking place is the product of the fractions representing the probabilities of the two events, and similarly for a larger number of independent events. Thus, suppose there are two urns, the first containing 5 black and 9 white balls, the second 3 white and 18 black balls. The probability of drawing a white ball from the first is $\frac{9}{14}$, and from the second $\frac{3}{21}$; therefore the probability of drawing a white ball from both is $\frac{9}{14} \times \frac{3}{21}$, or $\frac{9}{98}$. Similarly the chance that a black ball will be withdrawn from both is $\frac{5}{14} \times \frac{18}{21}$, or $\frac{45}{98}$; for a white from the first and a black from the second urn the chance is $\frac{9}{14} \times \frac{18}{21}$, or $\frac{27}{49}$; and for a black and a white respectively, $\frac{5}{14} \times \frac{3}{21}$, or $\frac{5}{98}$. These four cases are the only possible ones, and therefore, as we should expect, the sum of their probabilities is unity. In the case of a lottery for money the probability of any particular person winning the prize multiplied by the amount of that prize is called his *expectation*. The theory of mathematical probability has been applied to many kinds of problems, some of them of great practical interest, and others only valuable as

intellectual exercises. Dr. Pole's *Philosophy of Whist* contains a very interesting discussion of the bearings of the theory on the modern game of whist, and he works out in full all the probabilities required in the scientific game. The credibility of witnesses and the probabilities connected with evidence also furnish an important class of questions within the scope of the theory; but the most important application of the doctrine of probabilities is in questions of life insurance and annuities. The data in this case are furnished by tables of mortality. The following works deal with the theory of probabilities either on its logical or on its mathematical side: Todhunter's and other treatises on Algebra; De Morgan's Formal Logic; Todhunter's History of the Theory of Probability; Venn's Logic of Chance; Whitworth's Choice and Chance; Boole's Laws of Thought.

PROBATE, COURT OF, an English tribunal established by act of Parliament in 1857, to which all the powers that had been previously exercised by the ecclesiastical courts in the granting of probates of wills and letters of administration were transferred. This court was merged in the Supreme Court by the Judicature Act of 1874, by which its jurisdiction was assigned to a Probate, Divorce, and Admiralty Division. The functions of the probate branch are confined entirely to deciding on the authenticity of wills and upon the proper persons to whom administration is to be committed when no will exists. If a party dies leaving a will it must be produced and verified at the registry in London or the district registries of the court in various parts throughout the kingdom, so that all concerned may be convinced of its authenticity. If its authenticity, after the examination of witnesses, is demonstrated the will is then registered, and the original deposited in the court. The act of court by which the will is proved is termed the probate of the will. On the other hand, if the party dies intestate application must be made to the court to appoint one of the next of kin as administrator of the personal estate of the deceased; this is done by the court by granting what is termed a letter of administration. In cases where a person dies in one of the districts, leaving personal property under £200, the judge of the county court of the district has jurisdiction should any contention arise, but his decision may be appealed from to this division of the Supreme Court. The practice of the court is thrown open to the whole legal profession, and its proceedings are otherwise assimilated to the courts of common law.

PROBOSCIDEA, in recent systems of Mammalian classification an order including the Elephants alone, which are distinguished, as implied by this name, by the possession of the characteristic proboscis or trunk (see next article). The order is sometimes made a subdivision of the Ungulata or hoofed Quadrupeds. See ELEPHANT, MAMMALIA, &c.

PROBOSCIS, the term applied to the longer or shorter flexible muscular organ formed by the elongated nose of several mammals. Although seen in a modified degree in the Tapirs, &c., the term is more generally restricted, and applied to indicate the flexible 'trunk' of the Elephants, this structure having been in all probability also possessed by the extinct Mammoths, Mastodons, and Deinotherium. One of the Monkeys, the Proboscis Monkey (which see), also possesses an elongated nose, this form being found in Borneo. The proboscis of the elephant exhibits a highly-complicated muscular structure, and is formed essentially of a modification of the muscles of the nose and lips. Two *elevator* muscles arise, one on each side, from above the nasals; a second pair of *depressors* take origin from the premaxilla, and a third pair of *lateral and longitudinal muscles* arise on each side from

the frontal and maxillary bones. In addition to these representative muscles, homologous with those of other forms, the proboscis possesses a large number of intrinsic and special muscular structures, the fibres of these latter extending from the nasal passages to the inner surface of the skin, and tending by their action to keep the nostrils patent and open. The conical tube, 4 or 5 feet in length, thus formed, is elongated, tapering, and truncated, and funnel-shaped at its free extremity; a concave surface containing the openings of the nostrils. The free extremity is provided with a movable finger-like appendage, by means of which the smallest objects may be readily picked up. Internally the proboscis exhibits the structure of a double tube corresponding to the nostrils. These tubes are continued upwards to the true or bony nostrils of the skull; but before their union with the bony structures the tubes are curved, and the nostrils are guarded at this point by an elastic valve of cartilaginous material. The use of this valvular structure is to prevent fluids and other substances from entering the true nasal passages; the valve being ordinarily kept closed by muscular action or its own elasticity, but being readily opened at the will of the animal. The numerous muscles of which the proboscis is chiefly composed enable the structure to be manipulated and used in every conceivable manner. It thus performs the functions of an arm and hand; it is an organ of touch and of smell, and may be used as a powerful weapon. The proboscis is convex or rounded on its upper surface, and fluted along its breadth, the lower side being more or less flattened.

PROBOSCIS MONKEY (*Presbytis larvatus* or *nasalis*), a genus of Quadrumana or Monkeys, included in the Catarrhine section of that order, and closely related to the genus *Semnopithecus* of Asia. The Proboscis Monkey or Kahau is a native of Borneo, and is distinguished by the elongated nose, giving a peculiarly ludicrous appearance to these forms; by the shortened thumbs, and elongated tail. The nose is capable of being dilated, and the nasal apertures open beneath the somewhat curved point; the ears are of small size; the face and palms are of a leaden yellow colour; the hair on the sides of the head and neck is longest; the upper parts of the back and head are coloured of a chestnut brown, the sides of the face and shoulders being yellow. The general body-colour is a sandy red; the tail is dark above, but of a light yellow colour beneath. The males possess prominent canine teeth, and the name 'Kahau' has been applied to these forms from its resemblance to their cry. These monkeys are arboreal in habits, and appear to frequent the neighbourhood of streams and rivers, congregating in troops. See the plate at the article **APK**.

PROBUS, MARCUS AURELIUS, one of the ablest of the Roman emperors, was born at Sirmium in Pannonia in the year 232. His father Maximus, after having served with distinction as a centurion, was promoted to the rank of tribune, and died leaving but a very small fortune to his children. At a very early age Marcus attracted the notice of the Emperor Valerian, who at once conferred upon him the office of tribune, an act which was fully justified by the skill and bravery he displayed in the wars in which he was thereafter engaged. He was soon placed at the head of a legion, and the brilliancy of his conduct in the African, Persian, Arabian, and Germanic campaigns brought him into still more prominent notice. He was nominated governor of all the Roman provinces in Asia by the Emperor Tacitus, and was in command of the Syrian legions when, in 276, Florianus, who succeeded his brother Tacitus, was murdered. Such was the favour in which Probus was held by senate and people, as well as by his sol-

diers, that he was immediately proclaimed emperor by universal consent. His chief struggle during his reign was to guard the frontiers of the empire against the barbarians. He drove back the Franks, Burgundians, Alemanni, and Vandals, who had invaded Gaul; and once more, in 277 and 278, secured the frontier wall which (built between the Danube and the Rhine) separated the Decuman fields of the Romans from the free Germans. He also freed the lands south of the Danube, Egypt (which the African Blemmyes had invaded), and the East from devastating barbarian hordes; lastly he expelled the Goths and Alans from Asia Minor, drove back the pillaging Isaurians, concluded an advantageous peace with the Persians, and gained the superiority over the rebel Saturninus and the rival emperors Proculus and Bonosus. With regard to the internal condition of the empire, he gave new dignity to the senate, and with the view of giving a population to the desolate frontier provinces, gave settlements to large masses of barbarians, as well as to 100,000 Bastarnæ in Thrace—a measure, however, which, though well meant, was clearly no less dangerous than was the admission of 16,000 barbarians into the legions. He paid particular attention to agriculture, abolished an ancient law which, aiming only at the advantage of Italy, prohibited the culture of the olive and vine in the Transalpine provinces, and thus introduced the culture of the olive into Provence, and of the vine into Gaul, Rhine, and Pannonia. He kept his soldiers actively employed in public works, as the making of roads and draining of marshes. Irritated, however, at being charged with occupations which they deemed degrading, they took advantage of the opportunity afforded by his presence among them while draining the swamps about Sirmium in 282 to rise in insurrection and assassinate him. A skilful military leader, and a statesman with views as elevated as they were just, Probus united to great talents some of the fairest virtues. He was one of the few Roman emperors who did honour to humanity.

PROBUS, MARCUS VALERIUS, a well-known grammarian, born at Berytus in Syria, lived in the first century of our era under Nero until the time of Domitian, and wrote several works, including Scholia on Terence and Virgil, which have been lost. A work entitled *Institutionum Grammaticarum Libri Duo*, and a treatise on Roman Stenography, bear his name, but belong to a later period.

PROCACCINI, the name of a family of artists of the sixteenth century from Bologna.—1. **ERCOLE PROCACCINI**, born in 1520, was the head of a school of painting which he founded at Milan on similar principles to that of the Caracci at Bologna, but with less success. His works, existing at Bologna and Parma, are not remarkable for talent, but exhibit an industry and care which accorded with the mannerism of his contemporaries, and made him in great request as a teacher.—2. **CAMILLO PROCACCINI**, son and scholar of the former, born in 1546, was the most distinguished artist of this school. He profited much by studying the school of the Caracci, and selected especially Correggio and Parmegiano for his models. The imitation of them in some of his paintings is equally obvious and successful. He is very unequal, however, and not unfrequently betrays a kind of flightiness and forgetfulness of nature. His best works are in the churches and gallery of Milan. Among others may be mentioned a Madonna and Child in the church of Santa Maria del Carmine, and a Homage of the Kings in the Brera. He died at Milan in 1628.—**GIULIO CESARE PROCACCINI**, brother of the former, born in 1548, likewise strove to equal the school of the Caracci, and took for his model Correggio, whom he imitated with so much success

that several of his pictures, though far from reaching the grace and harmony of that great master, have often been ascribed to him. This has been the case especially with cabinet pictures of the Fall. His works are to be met with in many galleries. The exact year of his death is not known, but is supposed to have been, like that of his brother, in 1626.

PROCEDURE, CIVIL, is the method of proceeding in a civil suit throughout its various stages. In England, when redress is sought by law for a civil injury, the injured party brings an *action* against the party whom he alleges has done the injury. This action he may bring either *on the case*, as a general action, where the law has provided no specific remedy for the violence done; or *upon a statute*, under which he seeks redress either by the express words of the statute, or by implication. Action *qui tam*, or *popular action*, is such as is given by acts of Parliament, which create a forfeiture and impose a penalty for the neglect of some duty. The person who raises an action is termed the *plaintiff*, and he against whom the action is brought the *defendant*. It is usual before the suit is commenced for the plaintiff's attorney to acquaint the defendant by letter with the demand of his client, and state that unless complied with legal proceedings will be instituted. Should this not have the desired effect, the action is begun as a rule by issuing against the defendant a *writ of summons*, which is a judicial writ proceeding from the court which takes cognizance of the action, commanding him to enter an *appearance* in the court, failing which an appearance will be entered for him by the plaintiff. (See NON-APPEARANCE.) When an appearance has been entered both parties to the suit are now said to be *in court*, and judgment may be proceeded with. The next stage is the *pleadings* or the statements in legal form of the cause of action or ground of defence brought forward by the respective sides. They begin by the plaintiff delivering an instrument to the defendant, a *statement of claim*, containing the subject-matter of the complaint or ground of action, which must be presented within eight days. This is answered by the defendant in a *statement of defence*. Among other pleas the defendant may plead the statute of limitations. Personal actions for trespass or debt on simple contract must be commenced within six years after the cause of action, and actions of assault, menace, or imprisonment within four years after the commission of the injury. Actions on bills of exchange, attorneys' fees, and a demand for rent on a *parole* lease, as well as in matters connected with mercantile accounts and trade, must be within six years. An action for the recovery of land must be brought within twenty years from the time at which it might first have been raised. No arrears of rent or of interest in respect of any sum of money charged upon or payable out of land or rent, or in respect of any legacy, is recoverable after the expiration of six years from the due date. It is provided, with regard to pleadings, by the Common Law Procedure Act of 1852 that where the parties are agreed as to the question of fact to be decided between them, they may, by consent and order of a judge, proceed to trial without formal pleading. The next stage of procedure after the pleadings is the *issue*, which may be either on matter of law, when it is called a *demurrer*—the statement of facts being admitted, but the law arising upon those facts as stated by the opposite party being denied—or on matter of fact, where the fact only is disputed. A demurrer is determined by the judges after hearing argument on both sides, but an issue of fact has to be investigated before a jury, and this is denominated *trial by jury*. (See JURY and JURY TRIALS.) After the judge has summed up to the

jury the *verdict* follows and then the *judgment* of the court. There are certain cases, however, in which judgment may be suspended and a new trial granted where there has been any defect in the trial; but if the judgment is not suspended, appealed against, or reversed, then follows the final stage of the proceedings, the *execution* or enforcement of the sentence, which brings the suit to a conclusion.

PROCESSION, RELIGIOUS, a solemn march of the clergy and people, attended with religious ceremonies, prayers, singing, &c., around the altars and churches, or in the streets, for the purpose of returning thanks for some divine blessing, or averting some calamity, &c. The practice of holding such processions is usually said to have been introduced into the Christian church in the reign of Constantine. The most celebrated processions which now take place in the Roman Catholic Church are those of the eucharist on Corpus Christi day, and during the week in which it occurs. They owe their origin to John XXII. The processions in honour of St. Mark and those on Candlemas and Palm Sunday are said to have been instituted by Gregory the Great. Religious processions are not held in Protestant countries. Instances of celebrations of this nature are to be found among the Jews in the Old Testament, and as a part of the symbolical worship of nature they were in use among the ancient heathens; thus they formed solemn processions about the fields, which had been sowed, and sprinkled them with holy water to increase their fertility, and to defend them from injuries. The festivals in honour of Bacchus, Ceres, Diana, and other divinities, among the Greeks and Romans, were solemnized with processions, in which the images of the gods were borne about; and similar rites are still found among most heathens. Among the Buddhists these ceremonials are especially imposing. The procession which accompanies the Emperor of China when he goes to offer sacrifices to an idol in some great pagoda is one of the most gorgeous description.

PROCESSIONAL, a service-book of the Roman Catholic Church, containing the prayers to be said and the hymns to be sung at different stages in religious processions. Some of the processional of ancient date are very rare, and highly valued by book-fanciers. Among the rarest is that used by the see of York, and printed in a revised form in 1530.

PROCESSION OF THE HOLY GHOST. See GHOST (HOLY).

PROCIDA (anciently, Prochyta), an island in Italy, Naples, lying nearly midway between the island of Ischia and the coast of the province of Naples. It is about 3 miles long, north-east to south-west, and little more than 1 mile broad. The principal place of the island is Procida, or Castello di Procida, which stands on the south-east coast, 12 miles w.s.w. of Naples. It is fortified, has a good harbour, and a considerable trade. There is a palace on the island which was occasionally used as a residence by the former kings of Naples. On festivals the women assume the Greek costume, consisting of a red upper garment with gold embroidery. It is from this island that Giovanni da Procida, the reputed originator of the massacre known by the name of the Sicilian Vespers, takes his name. Pop. of the island, about 12,000.

PROCIDA, GIOVANNI DA. See SICILIAN VESPERERS.

PROCLAMATION, ROYAL, a public notice made by the sovereign of a country to his subjects, concerning any matter which he thinks fit to give notice about. It may consist either of an authoritative announcement of some great event affecting the state, or the declaration of the exercise of some royal prerogative (as in the summoning, prorogation, and

dissolution of Parliament), or of the intention of the crown to enforce some law that has remained dormant. A royal proclamation must be issued under the Great Seal. A statute of Henry VIII. making royal proclamations of equal validity with acts of Parliament was repealed by 1 Edward VI. cap. xii. Act 1 Will. and Mary, cap. ii., denies the crown the power of suspending or dispensing with any existing law by proclamation. Hence it follows that royal proclamations are only binding when they do not contradict existing laws or tend to establish new ones.

PROCLUS, a philosopher of the Neo-Platonic school, born at Byzantium in 412; died at Athens in 485. He is usually called the Lycian, because his parents came from Xanthus in Lycia. He received his first education at Alexandria from the famous Peripatetic Olympiodorus the elder, and completed it so thoroughly at Athens under Syrianus, who ultimately appointed him his successor, and under the guidance of Asclepigenia, who had acquired from her father Plutarchos the doctrines of the orphic and Chaldaic mysteries and the united theurgic sciences, that he was familiar with all branches of philosophy and theology. As a teacher at Athens he was very successful. His system aimed at the widest comprehensiveness. Hence he not only endeavoured to unite into a single whole all the philosophical schemes that had been handed down from former ages (one of his works, now lost, was devoted to showing the agreement subsisting between Orpheus, Plato, and Pythagoras); but made it a maxim that a philosopher should embrace also all religions by becoming infused with their spirit. Following out this maxim he composed hymns in honour of the pagan deities of Greece, defended and interpreted the popular myths regarding them, and even observed the rites connected with their worship, and considered himself as honoured by their special protection. It was probably in consequence of this adherence to the ancient religion of Greece in opposition to the decrees of the emperors who were now Christian, that Proclus was compelled to withdraw himself for a time from Athens. He travelled for a year in Asia, and took advantage of his sojourn there to study the various religions of its inhabitants. All of them he held in reverence, although he still continued to be more peculiarly attached to the religion of ancient Greece. On his return to Athens, where he remained till his death, he re-opened his school, but he now performed his religious services in secret, and reserved certain of his doctrines for the most intimate and trusted of his disciples. By his pure morals and religious views he gave his scholars the idea that he had intimate intercourse with gods and demons, and could work miracles. In his writings he professes to return to Plato, and to bring down Neo-Platonism from the misty heights to which it was raised by Plotinus. He also claims to resemble Plato in supporting his doctrines by an unbroken chain of reasoning, a method that had been altogether neglected by the previous Neo-Platonists. But these pretensions are not borne out by the works of his that have come down to us. The logical connection of his doctrines is only apparent, and as for the doctrines themselves they are equally unintelligible with those of his predecessors. A life or rather eulogy of Proclus was written by Marinus, one of his scholars, and his successor in the school at Athens. His extant works include a Sketch of Astronomy, in which he gave a short view of the systems of Hipparchus, Aristarchus, and Ptolemy; The Theology of Plato, Principles of Theology, Principles of Philosophy, a Commentary on the Works and Days of Hesiod, Life of Homer, &c. The best edition of his works

is by Victor Cousin (six vols. Paris, 1820-27). Several of his works were translated into English by Thomas Taylor, 'the Platonist.'

PROCONSUL and PROPRAETOR. The administration of the Roman provinces was originally intrusted to praetors, but at a later period to proprætors, that is, praetors whose term of office had expired, and still later also to proconsuls, or consuls whose term of office had expired. The first consul who had his period of office prolonged, and received the title of proconsul, was Q. Publilius Philo in B.C. 327. This was done in order that he might have the opportunity of concluding a campaign that he had successfully begun in Lower Italy. After the Roman Empire had been extended over many countries it was provided by a law of C. Sempronius Gracchus that, at the consular and praetorial *comitia*, the senate should distribute the provinces into two consular and six praetorial provinces, for which the consuls and praetors should cast lots or divide them among themselves by agreement, a few days after their entrance upon office, after the expiration of the term of which they became the governors of the provinces allotted to them. Such at least was the arrangement till 55 B.C., but in that year it was provided by a decree of the senate that no consul or praetor should enter on the government of a province till five years had elapsed from the close of his consulship or praetorship. As the Roman rule was extended the number of praetorial provinces increased, for since there were never more than two consuls there could not be more than two proconsuls, unless the term of office of the latter were prolonged over more than one year, or (which was still more rarely the case) some person were appointed proconsul who had not previously held the office of consul. The duties of these provincial magistrates were the administration of justice, the supervision of other affairs of the province, and the command of the troops which were stationed in it. They were assisted in their duties by quaestors and legates. Within thirty days after his return to Rome the provincial governor was bound to make a report of the acts of his government and of the state of the province. The *Lex Julia* in 61 B.C. further required that a copy of his report (*rationes*) should be deposited in each of the two chief cities of his province. If he had permitted any acts of injustice or oppression he could be impeached therefor; as for extortion (*res repetundæ*), peculation or embezzlement of the public money (*peculatus*), or for abuses in regard to the army (*crimen majestatis*). Notwithstanding these precautions the provinces were subjected to various oppressions and exactions. From the time of Augustus the government of some of the provinces, all those that required the maintenance of an army, was taken out of the hands of the proconsuls and proprætors, and intrusted to legates who governed under the immediate direction of the emperor. See PROVINCE.

PROCOPIUS, ANDREW, the *Sharen* or the *Great*, a celebrated Hussite chief of the fifteenth century. He succeeded Ziska in 1424 as commander of the Taborites, and became the dread of the troops of the Emperor Sigismund. He made himself master of a large part of Bohemia, and ravaged Moravia, Austria, and Silesia. In 1433 he appeared with a large following at the Council of Basel, and demanded, in the name of the Hussites, the reform of the manners of the clergy, liberty for the ministers of religion, and the right of the laity to have the sacrament of the Lord's supper administered to them as well as the clergy. As the section of the Hussites led by Procopius were not satisfied with the concessions made by the council war was resumed, but Procopius was killed soon after in a battle fought at Böhmissch-

brod (1434). In the same battle perished another Procopius, the *Little*, who was the head of another section of the Hussites called the Orphans, and was united with the Great Procopius in all his enterprises after 1427.

PROCOPIUS OF CÆSAREA, a Greek historian, a native of Cæsarea, in Palestine, where he is supposed to have been born about 500 A.D. Having come to Constantinople to practise as an advocate he attracted the notice of Belisarius, who appointed him his secretary, in which capacity he attended him in his expeditions, of which he wrote the history. After he returned to Constantinople, a little before 542, he was appointed by the Emperor Justinian a senator and afterwards (562) prefect of the city. He is supposed to have died at Constantinople about 565 A.D. His works are a History of his Own Times, in eight books, the first two relating to the Persian war, the two following to the war with the Vandals, and the remaining four to the Gothic war; and a History of the Edifices built or repaired by Justinian. A kind of scandalous chronicle of the court of Justinian, including a most degrading account of the personal history of the emperor, the Empress Theodora, and others, and entitled *Anecdota*, has been attributed to him by some writers. The best edition of his works is that of Dindorf (Bonn, three vols, 1833-38).

PROCORIS, daughter of Erechtheus, and wife of Cephalus. See **CEPHALUS**.

PROCRUSTES ('the Stretcher'), a celebrated robber of ancient Greek legend, whose bed is still proverbially spoken of. The monster placed his guests in the bed, and then if they were too short, under pretence of fitting the bed to the occupant, he stretched the latter till he died. If his guest was tall Procrustes reduced him to the proper dimensions by cutting and clipping. Theseus finally served him as he had served others.

PROCTER, BRYAN WALLER, an English poet, was born at Leeds in November, 1787; died in London, October 5, 1874. He was educated at Harrow, where he was the school-fellow of Byron and Peel. After finishing his school education he became an articled clerk to a solicitor at Calne, in Wiltshire. Subsequently he studied law in London, and in 1831 was called to the bar as a member of Gray's Inn. For some time he held the office of a commissioner of lunacy, but resigned it in 1860. His first appearance in literature was in 1819, when he published a volume, entitled *Dramatic Scenes and other Poems*. The author appeared before the public in this work under the pseudonym of Barry Cornwall, which he afterwards retained. This first essay was well received by the critics, and Charles Lamb said with regard to the dramatic scenes, that had he found them in an anonymous manuscript among the Garrick papers in the British Museum, he would have had no hesitation in giving them a place in his *Specimens of English Dramatic Poets* who lived about the time of Shakspeare. This was followed by *A Sicilian Story* and *Marcian Colonna*. In 1821 he produced a tragedy, *Mirandola*, which was performed with great success at Covent Garden. The poetical works of Procter, which were given to the world after *Mirandola*, were the *Flood in Thessaly*, and *English Songs* and other *Small Poems*. His prose works include *Effigies Poeticæ*, or the *Portraits of the British Poets*, a *Life of Edmund Kean*, a volume of *Essays and Tales*, and a *Memoir of Charles Lamb*. The last-mentioned work, which was published in 1866, and is the last that Procter wrote, is perhaps the most interesting of all his prose writings. It is the work of one who thoroughly understood Lamb, and who was one of his most intimate friends during the last seventeen or eighteen years of his life. As a

poet Procter does not take a very high rank in English literature; but he was nevertheless a true poet, distinguished as such for an intellectual refinement and grace, which excited the admiration of his brother poets, if they did not suit the popular taste.

PROCTOR (from the Latin *procurator*), a person who in the ecclesiastical and admiralty courts in England performs the duties of an attorney or solicitor. Since the abolition of the greater part of the jurisdiction of the ecclesiastical courts proctors have been admitted to practise in the Courts of Equity and Common Law, as well as in the Probate and Divorce Courts, to which the main functions of the ecclesiastical courts were assigned. In the English universities the proctors are two officers chosen from among the masters of arts, to superintend the scholastic exercises, to enforce the statutes, and to preserve the public peace. The name of proctors is also given to the representatives of the inferior clergy and the chapters of cathedrals in convocation.

PROCURATOR, among the Romans, an agent, an overseer of an estate; at a later period the title of a provincial officer inferior to the governor (see **PROVINCE** and **PROCONSUL**), who managed the revenue. In some of the small provinces, or in a part of a large province, the procurator discharged the office of a governor, and had the power of punishing capitally, as was the case with Pontius Pilate in Judæa, which was attached to the province of Syria.

Procurator or *proctor*, in monasteries, is the conventional to whom is intrusted the care of the temporal concerns.

Procurator di San Marco was the title of the chief officers or senators in the Venetian Republic. Besides the nine actual *procuratori*, from among whom the doge was chosen, there were also many titular procurators, who paid a great sum for this title, which was much coveted by the Venetian patricians on account of the rank it conferred.

PROCURATOR-FISCAL, in Scotland, an officer appointed to act as the public prosecutor in criminal cases before the sheriff, magistrates, or justices of the peace belonging to his district. It is only when the public interest is concerned that he ought to originate a prosecution; and when complaint is made by a person in a case in which it is more the private interest of the complainant than the public interest that is at stake it is the duty of the procurator-fiscal merely to give his concurrence to the prosecution, and not to institute the proceedings. He may, however, act as the complainant's agent; but even when he does so, if he only gives his concurrence, he is not liable to an action for malicious prosecution. When information of a crime committed within a procurator-fiscal's district has been laid before him, it is his business to ascertain the truth of the charge, to obtain from the sheriff, or justice of the peace, or some other magistrate, a warrant for the apprehension of the accused, and to see that the warrant is carried out, and in general to do whatever else is necessary to protect the innocent, and have the guilty person brought to justice. All recognitions or preliminary examinations of witnesses are taken by him before the sheriff or sheriff-substitute of the district. The procurator-fiscal has also, in conjunction with the sheriff, to discharge the duties of a coroner in making investigations with regard to persons who are suspected to have met their death from violence, or other than natural causes. The procurators-fiscal of counties are accountable to the crown counsel for the way in which they discharge their duties, and in cases of difficulty it is their duty to communicate with the crown-agent in order that they may have the advice of the crown-counsel. All fines imposed by court are payable to the procurator-fiscal, who

must account for them to the exchequer in cases which have been reported to the crown-counsel, and in other cases to the county and sheriff.

PRODUCTION, *Cosr or*, a phrase used in political economy, not always in the same sense even by the same writer. According to Mill's ultimate analysis of the cost of production of any article, the elements which necessarily enter into the determination of it are the quantity of labour expended upon that article, the wages of that labour, and the profits of the producer; or since the wages of labour are the measure of its quantity as well as of its value, the necessary elements may be reduced to the two, wages and profits. The element of wages includes, however, not merely the amount paid in wages by a producer to his own workmen, but also the wages paid to all the workmen who have been engaged in the preparation of the raw material employed by him, from the state in which it is found in nature to that in which it comes into his hands, and the wages paid to the makers of the machines that he uses, or rather that proportion of those wages that corresponds to the time for which the machines are employed in the production of the article in question. Besides these necessary elements in the cost of production, Mill mentions other two, taxes and any extra cost occasioned by a scarcity value of some of the requisites of production, which occasionally form elements in the whole cost. Mill, with two reservations, excludes rent from the cost of production. 'Rent,' he says, 'is not an element in the cost of production of the commodity which yields it, except in the cases (rather conceivable than actually existing) in which it results from, and represents, a scarcity value. But when land capable of yielding rent in agriculture is applied to some other purpose, the rent which it would have yielded is an element in the cost of production of the commodity which it is employed to produce' (*Principles of Pol. Econ.*, book iii. ch. vi. s. 1).

PRÆTUS, in fabulous history, twin brother of Acrisius, king of Argos. They quarrelled with each other in their mother's womb. Acrisius banished Prætus from Argos. He fled to Iolates or Amphianax, king of Lycia, married his sister, and by his aid conquered the city of Tiryns, in Argolis, where he founded a small kingdom. Here Bellerophon took refuge with him. His daughters, the Prætidæ, wandered about through Argolis and Arcadia, having become mad, either on account of their contempt of the mysteries of Bacchus, or of their derision of the statue of Hæra. According to later traditions they imagined themselves cows, and wandered through the fields with wild lowings; the same frenzy seized the other women of Argos also. Two of the daughters of Prætus were cured by Melampus, who received one of them in marriage. Ovid relates that Prætus expelled his brother Acrisius from his kingdom, and that Perseus, the grandson of Acrisius, revenged his death by changing Prætus into stone by showing him the head of Medusa.

PROFANE, an epithet applied in ancient times to uninitiated persons who were not allowed to be present at the sacred services, particularly those of Demeter and Bacchus, but were obliged to remain outside of the temple. The Romans used the word in a wider sense, applying it to the vicious in general. When everything was prepared for the sacrifice, the priest exclaimed, *Profani sacris eceat*. The word was afterwards used by Christians in contradistinction from *sacred*, as *profane literature*.

PROFESSED. See **JESUITS**.

PROFESSION, the act of taking the vows by the member of a religious order after the novitiate is finished. See **MONASTIC VOWS**.

PROFESSOR was the name given in the time of the Roman emperors to a public teacher, more especially to one who taught grammar and rhetoric. Such teachers were appointed with fixed salaries in Rome and others of the more important cities of the empire. The name, taken from the Latin verb *profiteri*, denotes that they publicly made themselves known as engaged in the pursuit of their particular art, and in the business of teaching it. In the universities of more modern times it is the title given to those salaried teachers who are appointed to deliver lectures in the four faculties. Those appointed to distinct chairs are in Germany usually called ordinary professors, in contradistinction to extraordinary professors, who are appointed to this rank after they have actively employed themselves for some years as Docents (Magistri Legentes), and satisfied the university teachers as to their qualifications. Recently the teachers of many gymnasiums and other superior training establishments, as conservatories of music, &c., have assumed the title of professor. It has even begun to descend much lower than this, and we now often hear of professors of dancing, cookery, &c.

PROFILE, in general, the view of an object from one of its chief sides, at which more or less of the other side is hidden from the eye; in particular, the contour of the human face viewed from one side. The traits of character are often expressed with peculiar strength in the profile. Only where great symmetry exists, connected with the preponderance of the intellectual over the sensual, will the profile appear finer than the front face. As the profile indicates more particularly the intellectual character of man, it is natural that in children it should be insignificant. In 1818 Professor Blumenbach received from the King of Bavaria a skull of an ancient Greek, found in a tomb of Magna Græcia. It may be considered as a model of the antique Greek profile, in respect of beautiful form. The nose is connected in a straight line with the forehead, and thus would contradict the theory that the profile exhibited in works of ancient Greek art was not an imitation of nature, but merely a style adopted arbitrarily in various schools.

PROFITS, the gains that a person makes by carrying on any production, or engaging in any business. Merchants in keeping their books often make a distinction between the interest on the capital employed in their business and the profits of their business, even though the capital they employ may be all their own. Profits in that case are estimated only after the interest on their capital has been deducted at a fixed rate from the clear returns of the business.

PROGNE, PROCNE. See **PHILOMELA**.

PROGRESSION, in algebra, a series of quantities, each of which is obtained from the one before it according to a certain rule. Thus quantities in 'arithmetical progression' increase or decrease by a common difference, as 1, 3, 5, 7, 9, &c., where the common difference is 2; or 30, 27, 24, 21, &c., where the common difference is -3. If *a* is the first term of an arithmetical progression, *l* the *n*th term, *d* the common difference, we have the following laws, which enable all problems to be solved:—

$$l = a + (n - 1) d.$$

$$\text{Sum of } n \text{ terms} = \frac{n}{2} (l + a) = \frac{n}{2} \{2a + (n - 1) d\}.$$

Quantities are in geometrical progression when the ratio of each to the preceding number is constant, as 1, 2, 4, 8, 16, &c., where the common ratio is 2, or 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, &c., where the common ratio is $\frac{1}{2}$; or *a*, *ar*, *ar*², *ar*³, &c., where the ratio is *r*. If *a* is the first term of a geometrical progression, *r* the com-

mon ratio, and l the n th term, we have $l = ar^{n-1}$, and the sum of n terms is equal to $\frac{a(r^n - 1)}{r - 1}$, or $\frac{r^l - a}{r - 1}$.

Three quantities, A, B, C , are said to be in harmonical progression when $A : C :: A - B : B - C$, and any number of quantities are said to be in harmonical progression when every three consecutive quantities are in harmonical progression. It is easy to prove that the reciprocals of quantities in harmonical progression are in arithmetic progression, and it is by means of this theorem that all problems are solved.

PROHIBITIVE SYSTEM, in political economy, the fostering of certain industries in a country, by imposing on all products of these industries imported into the country such a duty as practically amounts to the prohibition of these imports. See **FREE TRADE**.

PROJECTILES. When a body is thrown vertically upwards or downwards its motion continues to be rectilinear. (See **MECHANICS**.) If thrown horizontally, the body will move in a curved path, because it retains unchanged (leaving out of account the resistance of the air) its horizontal velocity, but it falls faster and faster towards the ground. When investigated by dynamics the curved path is found to be a parabola. A body projected obliquely has initially a certain horizontal velocity and a certain vertical velocity. Now it retains its horizontal velocity unchanged, but its vertical velocity is altered by the force of gravity, and we again find the curved path which it follows to be a parabola. With a given velocity the greatest range is obtained by projecting at an angle of 45° with the vertical. We have supposed the air to offer no resistance to the motion of the projectile, but in gunnery this resistance is of very great importance, because of the exceedingly great velocity of a bullet, and indeed in practice the above theory is not of very much use. The path of the bullet is always within the parabola of the theoretical projectile, and hence the range is much less than what the parabola would give. The range depends also upon the shape and weight of the projectile as well as upon its initial velocity. It is a very difficult task to construct the path of a projectile from beginning to end of its flight. See **GUNNERY**.

PROJECTION, in perspective, denotes the appearance or representation of an object on the perspective plane. (See **PERSPECTIVE**.) The term projection is also applied to the various methods which have been adopted for representing the surface of the sphere upon a plane surface, as in map-making. They are described in the article **MAP**.

PROLAPSUS ANI, the protrusion of the gut at the fundament. This is most common in children and aged persons, but may happen at any age. It is often the result of straining in evacuation, and not infrequently appears in connection with piles. When such a protrusion takes place the best thing to do is to wash the parts and then replace them with the fingers, which should first be oiled. If this is done at once, and the patient continues in a horizontal posture for some hours afterwards, probably nothing else will be necessary; but if the gut cannot be returned in this way, or continue to fall again after being so returned, surgical aid should be sought. Persons liable to this accident should be careful to regulate their bowels so as to prevent costiveness and consequent straining. Regular bathing of the parts with cold water may also be found useful, as also cold injections into the bowel. A small quantity of a weak solution of sulphate of iron (1 grain of the sulphate to 1 oz. of rain or distilled water) is often recommended for injection in this manner.

PROLAPSUS UTERI, 'falling down of the womb,' or 'bearing down,' a common affection among women who have born large families, especially when they have got up too soon after confinement, and hence most common among women of the lower ranks, who are often obliged to neglect themselves in such circumstances. It is not, however, by any means confined to them, nor even to women who have born children, sometimes occurring in virgins, and in very rare cases in infants. It is not uncommonly the result of straining in consequence of constipation. What renders the falling down of the womb possible is a general laxity of the parts supporting it, either of the ligaments which ought to uphold it or of the vaginal canal. The falling down may be of various degrees, from the slightest downward displacement to such a descent as causes external protrusion of the womb. In the latter case it is called perfect, and in the former imperfect prolapsus. French surgeons distinguish three degrees of the affection. The first is when the womb does not descend lower than 6 centimètres (2½ inches) above the vulvar orifice; the second when the orifice of the womb may be seen at the vulva while its lips are distended; the third when there is actual protrusion. In the first two cases the symptoms are less grave than in the third. Leucorrhœa and a sensation of fulness or weight, as of a body falling between the great lips of the vulva, are then the principal indications of the affection. Yet the general health is said to suffer more when the prolapsus is slight than when it reaches the third degree. In this last stage the mucous membrane of the vaginal canal, which then covers the prolapsed part of the womb, become wrinkled and ulcerated, the lips of the uterine orifice are partly open and sometimes reflected, the orifice itself becomes ulcerated, and there is an abundant leucorrhœa. The bladder and the rectum descend along with the womb, and there is always more or less difficulty in evacuating their contents. When the falling down once begins it always tends to increase, unless means are taken to prevent it. In all cases of this affection the first requisite for cure is prolonged rest in the horizontal position. When the case is mild, and arises from laxity in the walls of the vaginal canal, cold injections repeated night and morning will sometimes be enough to restore the tone of the mucous membrane of the canal, and enable it to support the womb. From half a pint to a pint of water may be injected on each occasion, and the injection should be made very slowly by means of an elastic bottle. When the simple cold injections are not enough, astringent injections are sometimes resorted to when there is no congestion or inflammation of the parts. When the womb protrudes it must be restored to its proper position, and this in most cases is not a matter of very great difficulty. When it has been restored to its place it must be retained there by some kind of mechanical means, such as a pessary or a compress and bandage.

PROLEGOMENA (Greek), preliminary observations, serving as an introduction to a work, to which they are prefixed, and containing historical, critical, &c., illustrations of its contents, language, form, &c.

PROLETARI, the name which was given to those Roman citizens who, in the classification of their means by Servius Tullius, stood in the sixth class, possessing less than 1500 asses, or nothing at all. They were ever afterwards distinguished by the name of *capite censi*, apparently because having too little means to be taxed on it, they were taxed only by head. The term has been revived in modern times as a designation of the lowest class of the community; but more frequently the collective appellation proletariat is used.

PROLOGUE, in dramatic poetry, an address to the audience which precedes the piece itself. It may be either in prose or verse, and is usually pronounced by one person. Among the ancients, the player who delivered this address was called the *prologus*, and was usually considered as a person of the drama. Thus, in the Amphitryon of Plautus Mercury appears as prologus. Prologues sometimes relate to the drama itself, and serve to explain to the audience some circumstances of the action, sometimes to the situation in which the author or actor stands to the public, and sometimes have no immediate connection with either of these persons or subjects. From the epilogue to *As You Like It*, it appears to have been the custom in Shakspeare's time for the prologue to be spoken by one of the actors who took a female part, and the epilogue by one who took a male part.

PROMETHEUS, a Titan, son of Iapetus and Clymene, a daughter of Oceanus; Æschylus makes Themis, Apollodorus Asia, his mother. He was the brother of Atlas, Menætiüs, and Epimetheus, and the father of Deucalion. His name means 'forethought,' as that of his brother Epimetheus signifies 'afterthought.' Cunning and fertile in expedients he opposed Zeus, the founder of the new race of the gods, whom he had at first supported. Zeus, who despised poor mortals, determined to extirpate them, and create a new race. But Prometheus prevented him, by secretly bestowing on men the fire which had been concealed by Zeus, and teaching them the arts. To punish this offence Zeus sent down Pandora, who brought all kinds of diseases into the world. He caused Prometheus himself to be chained by Hephestus on a rock of the Caucasus (the eastern extremity of the world, according to the notions of the earlier Greeks), where his liver, which was renewed every night, was torn by a vulture or an eagle. But Prometheus, knowing that from Io's race would spring a man (Heracles), who, after having encountered innumerable hardships, would deliver him from his chains, suffered with heroic firmness; he was even acquainted with the future fate of Zeus, which was unknown to the god himself. When the irresistible enemy of Zeus, generated by himself and Thetis, should appear, then Prometheus was to find a termination of his sufferings. Zeus must then be reconciled to him, because his fall could only be prevented by the counsels of Prometheus. These are evidently two traditions united by Æschylus. The cause of Zeus's anger against mortals, and determination to destroy them, is thus related by Hesiod. The gods once attempted to make an agreement with men at Mecone (afterwards Sicily), the object of which was to determine what honours the gods should enjoy, and what duties men should owe them for their protection. Prometheus appeared for men, that the gods might not impose too burdensome duties upon them in return for their protection. A bull was brought as an offering, from which the gods were to select what portion they chose for their share. After it was cut up Prometheus formed two heaps; in the one he placed the flesh and the fat entrails, wrapped in the skin of the bull, and covered with the stomach (considered the worst piece); in the other pile he placed the bones artfully concealed in the fat. Zeus, who did not see through the trick, chose for the gods, and selected the fat, in which he was indignant to find only the bones. Hesiod adds that from that time it became the custom to offer to the gods bones without flesh. In Lucian's dialogue, called Prometheus, Prometheus is accused not only of this division of the flesh, and of stealing the fire, but also of having created man. According to Apollodorus he formed man of clay and water, and bestowed on him fire, by kindling dry wood at the sun. Plato relates that

the gods had made the races of animals from earth and fire, but that they left to Prometheus and his brother Epimetheus (the husband of Pandora), to arrange the proportion in which these materials should be assigned to each. Epimetheus had distributed the best powers among the irrational animals, and Prometheus, that man might not be left altogether helpless, obtained for them by stealth from Hephestus and Athena the arts of fire. Others, poets as well as philosophers, have modified this mythus, according to their particular object.

PROMINENCES, COLOURS. In total eclipses of the sun immense prominences, tinted of a delicate rose-red, show themselves past the moon's limbs. Some of them are more than 80,000 miles in height. From spectroscopic observation of the eclipse of 1863 it was supposed that these prominences consisted of glowing hydrogen. Lockyer, in 1866, had suggested a means of observing the prominences at any time, but he did not get the use of proper instruments till 1868. In that year, after the eclipse, Lockyer (in London) and Janssen (in India) discovered independently that the prominences may be viewed in a telescope with a spectroscope attached which has a wide slit. It has been found that the prominences are detached elevations of hydrogen, a thick continuous stratum of which surrounds the sun. The rapid changes which take place in these prominences are very startling when we consider their enormous size. The following description of a change of form was observed by Professor Young. 'It [a prominence of hydrogen] had remained, with very little change, since the preceding noon—a long, low, quiet-looking cloud, not very dense or brilliant, nor in any way remarkable except for its size. It was made up mostly of filaments nearly horizontal, and floated above the chromosphere [see SUN] with its lower surface at a height of some 15,000 miles, but was connected to it, as is usually the case, by three or four vertical columns brighter and more active than the rest. Lockyer compares such masses to a banyan grove. In length it measures 3' 35", and in elevation about 2' to its upper surface—that is, since at the sun's distance 1" equals 450 miles nearly, it was about 100,000 miles long by 54,000 high. At 12'30, when I was called away for a few minutes, there was no indication of what was about to happen, except that one of the connecting stems at the southern extremity of the cloud had grown considerably brighter, and was curiously bent to one side; and near the base of another, at the northern end, a little brilliant lump had developed itself, shaped like a summer thunder-head. . . . What was my surprise, then, on returning in less than half an hour (at 12'55), to find that in the meantime the whole thing had been literally blown to shreds by some inconceivable uprush from beneath. In place of the quiet cloud I had left, the air, if I may use the expression, was filled with flying *débris*—a mass of detached vertical fusiform filaments, each from 10" to 30" long by 2" or 3" wide, brighter and closer together where the pillars had formerly stood, and rapidly ascending. When I first looked some of them had already reached a height of nearly 4' (100,000 miles), and while I watched them they rose with a motion almost perceptible to the eye, until in ten minutes the uppermost were more than 200,000 miles above the solar surface. . . . As the filaments rose they gradually faded away like a dissolving cloud, and at 1'15 only a few filmy wisps, with some brighter streamers low down near the chromosphere, remained to mark the place. But in the meanwhile the little 'thunder-head' before alluded to had grown and developed wonderfully, into a mass of rolling and ever-changing flame, to speak according to appearances. First it was crowded

down, as it were, along the solar surface; later it rose almost pyramidally 50,000 miles in height; then its summit was drawn out into long filaments and threads, which were most curiously rolled backwards and downwards like the volutes of an Ionic capital; and finally it faded away, and by 2'30 had vanished like the other.'

PROMISE, an engagement entered into by one person to perform or not perform some particular thing. When there is a mutual promise between two parties it is termed a contract. A promise may either be verbal or written. A verbal promise is in England called a promise by parole, and a written promise is in technical language there called a covenant. By English law no promise is binding unless it was made for a consideration, but by Scotch law it is always binding whether a consideration was given or not. The law of Scotland makes a distinction between a promise and an offer, the former being an engagement of such a nature that the promiser thinks it unnecessary to secure the consent of the person to whom the promise is made, while the latter is an engagement dependent on the assent of the other party. A promise is binding from the first, but an offer is not binding until it is accepted, and if not previously accepted may be at any time withdrawn. In ordinary cases an offer, unless withdrawn, may also be accepted at any time; but with mercantile transactions a different rule is observed. An offer to buy or sell must be accepted by the person to whom it is made without undue delay, and while no change has taken place in the market disadvantageous to the offerer, otherwise he is no longer bound. When an offer is made, and it is stated that an answer is expected by return of post, the offerer is not bound after the arrival of that post without an acceptance. If the answer is expected from abroad it is held to be by return of post if it is sent by the first mail packet, even though private ships may have sailed previously. In case of a promise to marry, which is a mutual promise, either party, as is very well known, may sue for damages in case of the non-fulfilment of it.

PROMISSORY NOTE. See **BILL OF EXCHANGE**.

PRONOUN, a part of speech which resembles the noun in being used to designate a person, animal, or thing, but which differs from a noun in that it neither designates its object like a common noun, in virtue of the qualities which it possesses, nor, like a proper noun, always designates the same object, but designates different objects according to the circumstances in which it is used. A pronoun, in fact, has no connotation and no fixed denotation. The first personal pronouns, *I, we*, denote the person speaking or those represented by the person speaking; the second, *thou, you*, denote the person or persons spoken to; and the third personal pronouns, *he, she, it, they*, the person or persons or things spoken about. Demonstrative pronouns are those which relate to a present subject, as *this, that*; relative refer to some subject previously mentioned, as *who, which*; interrogative refer to some unknown subject; possessive indicate possession, as *mine, his*. Pronouns compounded with *self* or *selves* (as *myself, yourself, yourselves*) are usually called reflexive or reflective, but are as often intensive as reflexive. One in such a phrase as 'One would think so-and-so' may be called an indefinite pronoun. In English the form *its* is of comparatively recent origin. It does not once occur in Spenser, nor in the original (1611) edition of the Authorized Version of the Bible, though it is now to be found in Levit. xiv. 5; and it is not mentioned by the grammarian Alexander Gil (1619). It occurs but seldom in Shakspeare, and the first grammarian who recognizes it is John Wallis in 1653. In

most languages there are certain anomalies worthy of attention in the use of the pronouns. It is a general practice with sovereigns in all formal documents or proclamations to make use of the first person plural instead of the singular, and the same is the case with editors of newspapers and even to a large extent with authors. Most modern languages have dropped the singular of the second personal pronoun in ordinary social intercourse. In English and French the plural of the second personal pronoun is generally substituted, and the singular is now reserved almost exclusively as the mode of addressing the Deity. In English it is still sometimes used also in elevated style, and was formerly frequently used in addressing inferiors, as is common in Shakspeare. In French it is sometimes used between intimate friends. The Germans use in ordinary intercourse the plural of the third person (*sie*) instead of the second person singular, which is reserved for the Deity, intimate friends, inferiors, and children. In Italian the ordinary mode of address is the feminine of the third personal pronoun (*ella*), which is taken to be equivalent to addressing every person as 'your excellence' (*vostra eccellenza*).

PRONUBA. See **JUNO**.

PRONUNCIAMENTO, in Spain and the American republics where Spanish is spoken, a proclamation against the existing government, intended to serve as a signal of revolt. These risings are mostly the work of discontented officers, and hence are in the main of a military character; but they sometimes originate with civil bodies or individual towns and communes. The word *contrapronunciamento*, that is, counter-proclamation, also occurs.

PROOF. See **EVIDENCE**.

PROOF IMPRESSION. See **CORRECTION OF THE PRESS**, **ENGRAVING**.

PROOF PLANE, a small, thin, metallic disc insulated on a long stem of glass or vulcanite. A charge of electricity may be carried on it from one place to another. Coulomb employed it in his experiments on the distribution of electricity on conductors. When it is laid against the surface whose electric density we wish to measure, it forms, as it were, a part of the surface, and takes the charge due to the area which it covers; this charge may now be carried away to an electrometer and tested. Coulomb investigated the action of the proof plane. See also Clerk Maxwell's *Electricity*, sect. 223.

PROPÆDEUTICS (Gr. *propaideuō*, to prepare for instruction), a term first used by the Germans to indicate the knowledge which is necessary or useful for understanding or practising an art or science, or which unfolds its nature and extent and the method of learning it. It is applied, therefore, not only to special introductions to particular branches of study, but also to auxiliary sciences, logic, philosophy, &c., and the encyclopædic views of particular branches of science which facilitate an insight into the relations of the parts. Such a survey can be presented only by one who has studied a science in all its ramifications. The term *propædeutics* is often of course merely relative: thus philology belongs to the propædeutics of history, while it is itself the main study of a certain class of scholars. The term, however, in its common use is generally restricted to the body of knowledge and of rules necessary for the study of some particular science—rules which originate in the application of the general laws of science or art to a particular department. Thus we find in the catalogues of lectures to be delivered in German universities medical propædeutics, &c., enumerated.

PROPAGANDA, a name generally given to those institutions by which Christianity is propagated in heathen countries, more particularly to those which

were established in the seventeenth century, and especially that erected by the Papal court for the extension of its own power and the Catholic religion among those who were not Christians or Catholics. It is called the *congregatio de propaganda fide* (congregation for propagating the faith), and was founded by Gregory XV. in 1622. It consists of a number of cardinals with the cardinal prefect at their head, has a secretary and five subalterns as heads of five chief departments, and a vast number of inferior agents or employees. It is the central missionary association of the whole Roman Catholic church, and superintends and guides missionary operations in all parts of the world. Connected with it is the *collegium seu seminarium de propaganda fide*, instituted by Urban VIII. (1627) for the education of missionaries, students of all nationalities being here received and trained and maintained free of expense, from the age of fourteen years. There are weekly meetings for consultation among the superiors of the congregation, and the more important of its measures are submitted to the Pope for ratification. Converts to the R. Catholic church who have come to Rome are instructed and supported by its funds. Bishops and other clergy who have been expelled from places where they were working are also received and supported. The Roman Propaganda has a fine palace and a printing-press, celebrated for the works which issue from it. The efforts of the propaganda are directed towards the whole of the church in *partibus infidelium* in general, but more particularly to countries outside of Europe. All the countries of the earth are divided by it into provinces. In close connection with it stand a number of seminaries or colleges for missionaries in various countries, including England and Ireland. The great majority of the members of the propaganda are Jesuits and Franciscans. The means of communication between the bishops and the propaganda are the archbishops, or where there are no archbishops the permanent nunci or specially appointed Papal delegates. In the time of the French revolution secret societies, whose object was the propagation of democratical principles, were called *propagandas*. Propaganda has therefore come to signify any kind of institution for making proselytes.

PROPAGATION OF PLANTS. The most common method of propagating plants is of course by their seed. There are other ways, however, by which plants are propagated naturally. Some, for example, throw off runners from their stems which creep along the ground, and these runners take root at the buds, and send up new plants, which may be separated from the parent plants by cutting through the runners. Others throw off suckers from the root, and new plants are produced by them in the same way as when they proceed from the stems. The commonest artificial methods of propagating plants are budding, layering, the various forms of grafting, including inarching or grafting by approach, propagation by offsets and by slips—all of which methods are described in separate articles. Some plants (as the potato) are propagated by dividing the tubers or underground stems, each 'eye' or leaf-bud of which sends up a new plant. A few are propagated by cuttings of the leaves, which are either obtained by slipping off the petiole from the parent plant, or by taking fragments of the fleshy parts of the leaves themselves, as may be done in the case of the begonias and gloxinias.

PROPER NAMES. See NAMES.

PROPERTIUS, SEXTUS AURELIUS, a Latin elegiac poet, born in Umbria, near the borders of Etruria. Little is known of his life. The date of his birth has been variously given between 57 and 46 B.C.

The latter date is, however, extremely improbable. After the end of the civil war he found a patron at Rome in Mæcenas, through whom he obtained the favour of the emperor. He appears to have been the bosom friend of Ovid, to have lived mostly in Rome, in the enjoyments of love and poetry, and to have died there in the prime of life (about 12 years A.C.) He did not possess the natural ease and grace of Ovid and Tibullus, but is distinguished for his art and ingenuity and the brilliancy of his style. He is particularly happy in his description of heroic scenes. We have four books of his elegies. The last of the fourth book is the most highly esteemed, and is often called the 'queen of elegies;' yet it is not wholly free from the usual fault of the author—a straining after originality of expression. Love is the subject of many of his elegies, but not a noble, spiritual love, which, indeed, we must not look for in any Roman poet of that age, although all were not so entirely abandoned as Propertius to licentious descriptions. There are also in the fourth book several poems which, although written in the elegiac measure, yet, from their subjects, belong to the class of didactic and narrative poems. He makes a display of his learning when he handles subjects of mythology, and therefore affects our feelings less. In general he imitates the Grecian elegiac poets, particularly Callimachus the Alexandrian. The elegies of Propertius are usually published with the poems of Tibullus and Catullus. The best editions are Broekhuizen (Amsterdam, 1702 and 1727, 4to), Vulpius (Padua, 1755, two vols.), Burmann and Santen (Utrecht, 1780), Lachmann (Leipzig, 1816), Hertzberg (Halle, 1848-49), and Bahrens (1880), with English editions by Palmer, F. A. Paley, and J. P. Postgate. There is a translation in Bohn's series.

PROPHETS, among the Hebrews, inspired teachers sent by God to declare his purposes to his people. The ordinary Hebrew word for a prophet is *nabhi*, which by the majority of Biblical critics is interpreted as 'the one who pours forth or announces,' namely, the declarations of God. There are two other words used in the Old Testament as appellations of prophets. These are *roeh* and *chozeh*, both of which literally signify seer, and are uniformly so translated in the Authorized Version of the Scriptures. The word *roeh*, which only occurs ten times, is seven times applied to Samuel. It has been made a subject of dispute whether these words denoted separate classes of prophets, and if so, what is the class that each of them denotes; but it seems most likely that all the three words were used as designations of the same class, but applied to them in virtue of different attributes possessed alike by all. In the Septuagint the word *nabhi* is always rendered *propheta*, and in the Authorized Version *prophet*. The literal signification of this word is 'one who speaks for another;' but the word was generally used as meaning 'one who speaks for a god;' and it is in this sense of the word that it is applied to the Hebrew prophets, who were in general the messengers of God, both as revealing and as expounding his will. In one common acceptation of the word its sense has become narrowed to that of a 'foreteller of future events,' and this restriction of the meaning, which naturally resulted from one of the chief functions of the prophets as revealers of the will of God with regard to the future, had already taken place in the Greek word before it was introduced into English. But the wider acceptation still remains side by side with this narrower one, otherwise it could not embrace all those to whom the term is usually applied. In Ex. vii. 1, where it is said that Aaron shall be the prophet of Moses, the word seems to mean simply 'spokesman.'

Moses is the first who is referred to as a prophet

in the usual sense of the term (Deut. xviii. 15). Among those who in other parts of the Old Testament are spoken of as having or claiming prophetic powers are three prophetesses—Deborah (Judg. iv. 4), Huldah (2 Kings xxii. 14), and Noadiah (Neh. vi. 14). In the New Testament a prophetess called Anna is mentioned in Luke i. 36; 'virgins which did prophesy' are spoken of in Acts xxi. 9; and in Rev. ii. 20 is mentioned a woman, Jezebel, who called herself a prophetess.

From the time of Samuel frequent mention is made of a body of men bearing the general name of prophets, although we have no reason to believe that they were all specially called as the messengers of God. They were members of the schools of the prophets, in which young men of all the tribes were instructed in the law, and apparently also in sacred poetry and music, for all the prophetic authors of the Bible write in poetry, and on many occasions the members of the schools of the prophets are spoken of as playing on musical instruments. The first school of this nature appears to have been set up by Samuel at Ramah. Others were afterwards formed at Bethel, Jericho, Gilgal, and elsewhere. The members of these schools are usually spoken of collectively as the prophetic order among the Jews. The circumstance to which the institution of this order was no doubt due was the declension of the priesthood in the time of Samuel, and its object was to strengthen the attachment of the Jews to their religion, from which they had in a great measure fallen away, and to maintain that religion pure. From 2 Kings iv. 23, where the husband of the Shunamite woman who had lost her son by sunstroke represents to her the uselessness of visiting the man of God then, because it was neither new moon nor Sabbath, it would seem that the prophets were in the habit of holding weekly and monthly meetings. The prophetic order seems to have continued in existence down to the close of the Old Testament canon. The apocryphal books of the Maccabees and Ecclesiasticus speak of it as extinct.

It has been stated already that to be a member of the prophetic order did not imply any divine call to serve as a messenger of God to his people; but there are a few who are mentioned by name and are presented to us as acting in this capacity, divinely-inspired seers, who in an especial manner purified and exalted the religion and morality of their nation, defended the Mosaic theocracy against the encroachment of the kings and the laxity of the priests, and foretold the fate of states, with warnings, denunciations, and consolatory prophecies. Of these divine messengers sixteen are the writers of books that are admitted into the Old Testament canon. Four of these, Isaiah, Jeremiah, Ezekiel, and Daniel, are usually called the great prophets, and the remaining twelve, Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, Malachi, are called the minor prophets. These cannot with certainty be arranged in chronological order, and different arrangements have been given by those who have attempted to do so. They may, however, be divided into four groups in such a manner as to give us a partial chronological arrangement. First, there are three prophets who belonged to the Kingdom of Israel as distinct from that of Judah—Hosea, Amos, Jonah; secondly, there are eight prophets of the Kingdom of Judah—Joel, Isaiah, Jeremiah, Obadiah, Micah, Nahum, Habakkuk, Zephaniah; thirdly, two prophets of the captivity—Ezekiel and Daniel; and fourthly, three prophets of the return—Haggai, Zechariah, and Malachi. To the first group belong also Elijah and Elisha, the two great prophets, who are not the authors of any books in the canon. In each of these four groups the prophets are named in

chronological order according to one arrangement. It is not unlikely that the majority of these canonical prophets proceeded from the schools of the prophets, but from the nature of their mission it was not necessary that they should do so; and the declaration of Amos, 'I was no prophet, neither was I a prophet's son' (chap. vii. 14) is commonly, and no doubt correctly, understood as meaning that he did not belong to the prophetic order.

It has already been stated that it was one of the obligations of the prophetic calling to defend the Mosaic theocracy and the purity of religion against the laxity of the priests, who, being occupied merely with religious rites, were apt to exaggerate the importance of mere outward observance of the law, in opposition to which the prophets constantly maintain, as all exalted moral teachers must, the pre-eminent value only of essentials, sincerity of heart and uprightness of conduct. From this circumstance some have drawn the conclusion that there was an antagonism between the prophetic order generally and the priesthood as such; but this inference has been justly objected to as unwarranted. It was to be expected that the reproaches and exhortations of the prophets would be as much addressed to a degenerate and narrow priesthood as to a degenerate people. The patriotism which strongly characterizes all the Hebrew prophets was closely connected with their religious zeal. The Jewish people being the chosen of God and the immediate subjects of the divine ruler all the nations hostile to the Jews were necessarily the enemies of God. They might be his instruments in punishing and disciplining the Jewish people, but they were not the conscious and willing instruments, and the Jews could be allowed to fall under their power only in consequence of their own wickedness and apostasy. Hence it is the constant cry of the prophets that the people should turn to righteousness in order to be delivered from the hands of their enemies.

The predictive powers of the prophets have been the occasion of much controversy. The ability of the prophets to foretell the future was universally believed in by the Jews, and in one passage of the Old Testament is made a negative test of the justness of a person's claim to be a prophet. In Deut. xviii. 22 we read, 'When a prophet speaketh in the name of the Lord, if the thing follow not, nor come to pass, that is the thing which the Lord hath not spoken, but the prophet hath spoken it presumptuously, thou shalt not be afraid of him.' On the other hand, the Jews are expressly warned in the beginning of the thirteenth chapter of the same book against taking the coincidence of an event with a prediction of a prophet as in itself evidence of the trustworthiness of the prophet. The main controversies with regard to this predictive power turn upon two points—first, the reality of the power, which is by some altogether denied; and secondly, the reference of the prophecies. Numerous works have been written with the sole object of confuting the first class of objectors, in order to do which successfully three things must be established: first, the fact of certain predictions having been made at a period so far antecedent to the events to which they relate as to make it incredible that those events could have been foreseen by any mere human sagacity; secondly, that the events did actually take place as foretold; and thirdly, that this correspondence of the event with the prediction cannot reasonably be set down as a mere coincidence. With regard to the reference of the prophecies the chief controversy is connected with the body of predictions scattered through all the prophetic writings of the Old Testament supposed to relate to the Messiah. With relation to these prophecies three different positions are

taken up by different schools of Biblical critics. Those who deny to the prophets the power of foretelling future events altogether necessarily deny also the reference of the prophecies in question to Christ as the Messiah, but refer all the passages which are supposed to point to the coming Messiah to historical events which happened at the time that the prophecies were uttered. Another school of critics, while admitting the reference of at least some of the passages to such historical events, contend that this is not the only bearing of the prophecies, which have thus a double reference, first, to these events of the time of the prophets, and secondly, to the Messiah. The third school, finally, hold that none but the Messianic interpretation is permissible. The nature and extent of the controversies that have been waged on this subject may be in some measure gauged by the divisions which exist among commentators with regard to one of the principal of the so-called Messianic prophecies, the fifty-third chapter of Isaiah. The ancient Jews understood this chapter as relating to the Messiah, but in modern times the Jews have been forced to abandon this view, and their chief expositors (Jarchi, Abenezra, Lipmann, &c.) refer it to the Israelitish people. Among Christians it was universally applied to Christ as the Messiah until the time of Grotius, who maintained that it ought to be understood of Jeremiah. Eichhorn, Rosenmüller, Koster, and others follow the modern Jewish interpretation. Eckermann, Ewald, and Bleek think that the ideal Israelitish people is figured in it. Knobel and others apply it to the godly portion of the Israelitish people. De Wette, Gesenius, Schenkel, and others believe it to refer to the prophetic body. Other commentators take it to point to King Uzziah, Hezekiah, the house of David, or Isaiah himself. And lastly, the Messianic interpretation is adopted by a large number of Biblical students, among the chief of whom are Michaelis, Reinke, Tholuck, and Stier.

Another subject of controversy with reference to the Hebrew prophets as the messengers of God is the state in which they were while receiving and uttering their divine communications. According to the Alexandrian Jews and the Montanists (see MONTANUS) they were in a state of ecstasy in both cases, that is to say, they lost all individual consciousness, power of independent volition, and became merely passive instruments of the divine spirit. When the divine spirit enters a human body, such theorists held, the human understanding must take its departure, for the mortal and the immortal cannot dwell together. This view was also that of the heathen, but was rejected by the early Christians, who considered that the Hebrew prophets spoke in a calm and sober state of the understanding, and were by this circumstance distinguished from heathen soothsayers. What appears to be the prevailing modern view on the subject is that in many, or perhaps in most cases, the divine communication or impulse came to the prophets while in their ordinary waking state, but that at other times they were received in the form of dreams or visions while the prophets were in a kind of trance or ecstasy. It follows from this that the prophets would not necessarily understand the full import of what had been revealed to them, even when they had recovered from the trance in which they were temporarily plunged, and began to exercise their reflective faculties on the divine communications.

Besides the prophets of the Old Testament, prophets and persons claiming to be prophets occur in the early history of the Christian Church. Thus the Acts of the Apostles records two appearances of a prophet named Agabus, who on the first occasion foretold a famine (Acts xi. 28), and on the second

occasion warned Paul of his danger in going up to Jerusalem (Acts xxi. 10). There are also in the New Testament the prophetesses already mentioned. The gift of prophecy is likewise mentioned as one of the Christian graces in Rom. xii. 6; 1 Cor. xii. 10; xiv. 37, 39. About the middle of the second century the Montanists especially boasted of their prophets (Montanus, Maximilla, Priscilla, &c.), who professed to be selected as the instruments of the Holy Spirit to guide the church and to prepare it for the second coming of Christ. In modern times religious fanatics have frequently pretended to be prophets without being able to demonstrate their claims to the title. The seventeenth century in particular was fruitful in prophets and prophetesses, and even in the beginning of the eighteenth century the prophets of the Cevennes excited a temporary attention. They were called in England the 'French prophets.' The subjects of their prophecies were the appearance of antichrist, judgments against the city of London, &c. They were condemned, as false prophets and disturbers of the public peace, to fines and to the pillory.

The following are a few of the principal works on the Hebrew prophets:—Lowth, *De Sacra Poesi Hebræorum* (Oxford, 1821), translated by Gregory (London, 1835); Davison, *Discourses on Prophecy* (Oxford, 1839); Eichhorn, *Die hebraischen Propheten* (Gottingen, 1816); Knobel, *Der Prophetismus der Hebräer* (Breslau, 1837); Hengstenberg, *Christology of the Old Testament*, translated (1854); Lee, *Inspiration of Holy Scripture* (1857); Pusey, *The Minor Prophets* (1861); J. Payne Smith, *Messianic Interpretation of the Prophecies of Isaiah* (1862); Davidson, *Introduction to the Old Testament* (1862); Ewald's *Prophets of the Old Testament* (1876-77); Kuenen's *Prophets and Prophecy in Israel* (1877); Prof. W. Robertson Smith, *The Prophets of Israel* (1882); Cornill's *Israelitische Prophetismus* (1896); Schwartzkopff's *Die Prophetische Offenbarung* (1896); Driver's *Old Testament Literature* (new ed., 1897).

PROPOLIS. See BEE.

PROPONTIS (so called by the ancients from being before the Pontus Euxinus or Black Sea), the sea lying between the Aegean and the Black Seas, and connected with them by the Hellespont and the Thracian Bosphorus; now called, from the largest of its islands, the Sea of Marmora.

PROPORTION, the equality of two ratios. Euclid's definitions of ratio and proportion are shown to accord with the more simple algebraic definitions, and the fifth book of Euclid, which was devoted to ratio and proportion, is now superseded by a few easy algebraic propositions. Ratio, in algebra, is expressed as a quotient or fraction. Proportion is expressed by the equality of two fractions; in short, by an ordinary equation. Thus the proportion a is to b as c is to d may be expressed in the forms $a : b :: c : d$,

or $a : b = c : d$, or $\frac{a}{b} = \frac{c}{d}$, or, as algebra teaches, $ad = cb$. Thus we have at once a most important property; if four quantities are proportionals, the product of the extremes is equal to the product of the means. We see also that if $a : b :: c : d$, then $a : c :: b : d$, and so on, such changes in arrangement being possible because of the equality $ad = cb$. Quantities a, b, c, d , &c., are said to be in continued proportion when $a : b :: b : c :: c : d$, &c. In this case $a = b^2$, and b is said to be a 'mean' between a and

c . It is easy to show that $\frac{a}{c} = \left(\frac{a}{b}\right)^2$, and the ratio of a to c is said to be the 'duplicate' ratio of a to b .

Also as $\frac{a}{b} = \sqrt{\frac{a}{c}}$, the ratio of a to b is said to be the sub-duplicate ratio of a to c . In algebra, when

quantities are in continued proportion, they are said to form a geometrical progression.

PROPOSITION. See LOGIC—Judgments.

PROPRÆTOR. See PROCOSUL.

PROPYL and its derivatives. Propyl (C_3H_7) is the third radicle of the series C_nH_{2n+1} . It does not exist in the free state, but enters into the composition of a large series of important compounds.

Propyl alcohol (C_3H_7OH). There are two alcohols of this name—the *normal alcohol*, obtained from fusel-oil, and the *iso-alcohol*, which may be obtained from ethyl alcohol. Derivatives of these two alcohols are known. Thus we have *normal propyl chloride*, C_3H_7Cl , and *iso-propyl chloride*, &c. The difference between the two series is generally shown by such formulas as these—



By replacing part of the hydrogen in ammonia by the radicle propyl we obtain *propylamine* $N \begin{Bmatrix} C_3H_7 \\ H_2 \end{Bmatrix}$, which is a strongly alkaline liquid. Two propylamines are known, namely, *normal* or $N \begin{Bmatrix} CH_2CH_2CH_3 \\ H_2 \end{Bmatrix}$, and *iso-* or $N \begin{Bmatrix} CH(CH_3)_2 \\ H_2 \end{Bmatrix}$.

PROPYLÆA (Greek), in Greek architecture, the entrance to a temple. The term was employed particularly in speaking of the superb vestibules or porticoes conducting to the Acropolis or citadel of Athens, which formed one of the principal ornaments of the city. This magnificent work, of the Doric order, was constructed by Pericles (B.C. 437–433) after the designs of Mnesicles, one of the most celebrated architects of his age. Pausanias says it was covered with white marble, remarkable for the size of the blocks and the beauty of the workmanship. The propylæa of the Acropolis of Athens still remain sufficiently entire to give a good idea of their former splendour as a portal.

PROROGATION OF PARLIAMENT, the continuance of Parliament from one session to another, as adjournment is a continuance of the session from one day to another, or for a longer period. Prorogation determines the session; but adjournment, though for a fortnight, month, &c., does not. After a prorogation any bill which has previously passed both houses, or either house, without receiving the royal sanction or the concurrence of the other house, must be taken up *de novo*. Parliament is prorogued by the king in person, or by his commissioners, headed by the lord-chancellor; or it may be done simply by proclamation.

PROSCENIUM, in Greek and Roman theatres, the place before the scene where the actors appeared, corresponding to what we call the stage. The front part of it, where the actors stood, was called in Greek *logeion* or *ocribas*, and in Latin *pulpitum*, and was coloured red by being sprinkled with crocus-water, for the sake of the perfume. It was somewhat higher than the orchestra, which was in front of it. The place behind the scene, where the actors dressed and undressed, was called *postscenium*. Projecting wings on each side of the proscenium were called *parascenia*.

PROSCRIPTION, in Roman history, a mode of getting rid of enemies, first resorted to by Sulla in 82 B.C., and imitated more than once afterwards in the stormy years that closed the republic. It literally signifies 'a writing before,' and commonly meant an advertisement or announcement of articles to be sold. But Sulla applied it to lists of names which he posted up in public places, with the promise of a reward to any person who should kill any of those named in the lists, and the threat of death to those

who should aid or shelter any of them. The persons named were said to be proscribed. Their property was confiscated and retained by Sulla, or distributed among his friends, and their children were declared incapable of honours. The most notorious proscription after that of Sulla (in which thousands of the noblest of Rome perished) was that of the second triumvirate—Antony, Octavius Cæsar, and Lepidus (B.C. 43), in which Cicero was among those who lost their lives.

PROSE (generally derived from *prorsus* (*oratio*), the reason of which will be given in the course of the article). The true character of prose can be clearly conceived only by considering it in relation to poetry. Their difference lies in the essential difference of certain states of the mind and feelings. The two chief states of the inward man may be called the *thinking* and the *poetical* states, and depend upon the predominance of the understanding, or the imagination and feelings. If we think (in the narrower sense of the word) we combine ideas according to the laws of reason; and prose, which is the language of sober thought, is characterized by the abstractness and generality of precision belonging to ideas that occupy the understanding. Prose, in the most common acceptation of the word, is used in contradistinction to metrical composition. The external form naturally strikes first, and in the early stages of society strikes most; hence the term *prose*, which, as we have already stated, is derived from *prorsus*, *prorsus oratio* (straight or direct speech), opposed to *verse*, which is derived from *versus* (turned), returning always to the selected metre. The Greeks called prose *ho pezos logos*, which the Romans translated *pedestris oratio*; and St. Evremond compares prose writers to modest pedestrians. Prose was also called by the Romans *oratio soluta* (free speech), in opposition to *oratio vincula* (bound speech) or *verse*, which is bound by rhythmical laws. From what has been said of the difference between prose and poetry it is clear that poetry must be much earlier developed than prose. Strong personal feeling naturally demands rhythmical expression, and in the early stages of society such is the only motive that is capable of leading to literary production. Oratory, it is true, selects a prose vehicle; but there is this difference between oratory and poetry, that the orator rather governs his feelings and directs them towards a practical object—that of inciting his hearers to some resolution—than allows himself to be swayed by them; whereas the poet allows himself to be swayed so far as is consistent with literary expression. Whenever the understanding predominates, as it does in oratory, prose is the natural vehicle; and although it is the case that histories, laws, and philosophical maxims were first conveyed in verse with the Greeks and many other nations, this may be explained partly by the fact that verse had established itself as the regular literary medium, and partly by this, that in these early times civilization was not sufficiently far advanced for the purely intellectual to be predominant over the emotional interest except in the one case of oratory. Pliny says that Pherecydes of Scyros (a contemporary of Cyrus) first formed the Greek prose (*prosam primus condere instituit*); but perhaps he was only the first who wrote on philosophico-mythological subjects in prose. Fine prose is among the latest attainments both of nations and individuals, and it would appear that with most nations classical prose writers are fewer than classical poets.

PROSECUTION, CRIMINAL. There is an important difference, according to English and Scotch law, in the method of originating a criminal prosecution. By the law of England there is no public prosecutor

whose duty it is to institute proceedings in a criminal prosecution in all cases where the public interest is mainly concerned; while by the law of Scotland that function is assigned to the lord-advocate and his assistants, the advocates-depute and the procurators-fiscal of burghs and counties. There is indeed a public prosecutor in England, the attorney-general; but he prosecutes only in the case of political offences and crimes of peculiar enormity. An officer called the 'director of public prosecutions' was, however, appointed (with six assistants) in terms of the Prosecution of Offences Act, 1879 (42 and 43 Vic., c. 22), but his action is confined to exceptional cases. In other cases it is left to the private parties more immediately concerned to institute criminal proceedings. The result of this is that many criminals are allowed to go free merely from want of a prosecutor, for the inevitable loss and the further risks connected with private prosecution are so great as in most cases to deter persons from entering on them. For in the first place the prosecution must be conducted wholly at the prosecutor's own expense, and although in the case of most crimes an allowance is made by the county in which the trial takes place, this allowance is usually found to bear but a small proportion to the whole expense that the prosecutor necessarily incurs. And in the second place, should the prosecutor not obtain a verdict, which is very often the case, he is liable to an action of damages for false imprisonment or malicious prosecution, and there is a great chance of his being condemned to pay a considerable sum on this account. In such cases the original prosecutor is indeed entitled to a verdict in his favour if he can show that he instituted proceedings in his prosecution under the reasonable and honest belief that he was accusing the guilty person, but it is a difficult matter to convince a jury of the reasonableness of such a belief when an innocent person has been charged with a crime, or even one who has not been conclusively proved to be guilty. This state of matters has long been regarded as unsatisfactory, but little has yet been done to remedy it. The absence of a public prosecutor in England was originally due to the dread which the English entertained of the liberties of the subject being invaded by the crown if such an instrument were placed at its disposal; but now that all reason for such dread is removed, the opinion is gaining ground that the best way to remedy it is to appoint such an officer as exists in Scotland. For information with regard to the procedure in criminal prosecutions see the articles ADVOCATE OF THE CROWN, JURY, PLEADING; and with special reference to Scotland, PRECOGNITION and PROCURATOR-FISCAL.

PROSELYTE (Greek, a stranger or new-comer), in religion, he who leaves one religion for the profession of another; in general, he who changes his religious party or any other party. The Jews had two classes of proselytes, namely, the 'proselytes of the gate,' as they were termed; and the 'proselytes of righteousness,' or of the covenant. Such at least is the distinction made by the Talmudic rabbis, most fully by Maimonides; but modern scholars entertain doubts as to whether this was not rather a theoretical division never made in practice in the precise form in which the rabbis represented it to have existed. It is, however, admitted that in New Testament times at any rate there were proselytes of two degrees, although it cannot be accurately determined how they were distinguished. According to the rabbis the proselytes of the gate were those who renounced idolatry and worshipped the only true God according to the (so-called) seven laws of the children of Noah, without subjecting themselves to circumcision and the other commands of the Mosaic law. They were only admitted to the court of the temple, and stood

at the door of the inner temple, whence their name. They had the right of dwelling in the land of Israel, but only in suburbs and villages. The proselytes of righteousness were persons who had been fully converted from paganism to Judaism, had been circumcised, and bound themselves to observe the Mosaic law. Before their circumcision they were examined respecting the grounds of their conversion; after their circumcision they received baptism, being immersed with their whole body in a cistern full of water, on a festival, in the presence of three judges. This baptism, known under the name of *proselyte baptism*, was repeated in the case of those children of a proselyte who had a heathen mother. Boys under twelve and girls under thirteen could not become proselytes without the consent of their parents, or, in case of their refusal, the aid of the magistrates. By the baptism every one was considered as born anew, so that his parents were no longer regarded as such, and slaves thus baptized were set free. Respecting the antiquity of Jewish proselyte baptism there has been much controversy. The rabbis taught that the proselytes of righteousness received from heaven a new soul and a new essential form. The Mosaic laws, moreover, excluded some persons from the privileges of proselytes, sometimes for ever, sometimes for a certain period (Deut. xxiii. 1-5).

PROSERPINE, the Latin name of Persephonē. See PERSEPHONE.

PROSODY (Greek, *prosōdia*), the part of grammar that treats of quantity, accent, and the laws of versification. See RHYME, RHYTHM, and VERSE.

PROSOPOPEIA. See PERSONIFICATION.

PROSSNITZ, a town in Austria, Moravia, in the circle of and 11 miles s.s.w. of the town of Olmütz, on the Rumza. It has three churches, an hospital, and monastery of the brothers of charity; extensive manufactures of woollen and linen cloth, cassimere and cotton goods, in all of which it carries on an important trade; numerous distilleries of brandy and rosolio, and one of the largest corn-markets in Moravia. Pop. (1890), 19,519.

PROSTYLE, a term used in architecture, defined by Gwilt as 'a portico in which the columns stand in advance of the building to which they belong.' The term *amphi-prostyle* is used when there is such a portico attached to a building both in front and behind.

PROTAGORAS, a Grecian philosopher, born at Abdera, in Thrace, apparently about 480 B.C. He was the first to assume the title of Sophist, and to teach for pay, a practice which Plato informs proved very remunerative to him. He taught principally at Athens. When, about 445, a number of Athenians left the city to join in founding the new colony of Thurium, Protagoras drew up a constitution for the Thurians, and he is conjectured by some to have accompanied the colonists. At any rate he was absent from Athens for a number of years subsequent to this. During part of his absence he dwelt in Sicily, where he acquired great fame. He returned to Athens before 430 B.C. In 411 B.C. he was accused of atheism, for beginning one of his works (*Peri Theōn*—Concerning the Gods) with the words, 'Respecting the gods, I am unable to know whether they exist or do not exist.' For this he is said by some to have been banished; others only mention that the work in which the statement occurs was publicly burned. He seems to have died soon after, perhaps in the same year. He was the author of a large number of works, all of which are lost. The two most important of them were the one already mentioned, and another entitled *Truth* (*Alētheia*). One of the dialogues of Plato bears the title *Protagoras*, and

from it interesting information is derived regarding his mode of teaching.

PROTECTION, in political economy, a method of encouraging industries in a country, by imposing on the products of these industries from other countries, when imported, a tax sufficient to protect the home producers against the competition of foreign ones. This practice is generally condemned by English political economists as enriching a comparatively small number of producers at the expense of the great mass of consumers, who, on account of the protection, have to pay more for the protected articles they want than they would otherwise have to do, and as encouraging certain industries only by withdrawing the people from others for which the country is better adapted by nature. See **FREE-TRADE**.

PROTECTOR, a title conferred on several occasions in the history of England on those appointed to act as regents, generally during the minority of the king. Those on whom it was conferred were the Earl of Pembroke, in 1216, during the minority of Henry III.; Humphry, duke of Gloucester (1422-47), during the minority of Henry VI.; Richard, duke of York, Feb. 1454 to Feb. 1455, and Nov. 1455 to Feb. 1456; Richard, duke of Gloucester, in 1483, before the death of the young princes his nephews, and his own accession to the throne; and the Duke of Somerset (Jan. 1547 to Oct. 1548), during the minority of Edward VI. On the 12th of December, 1653, the title of lord-protector was bestowed upon Cromwell, as head of the Commonwealth of England, by the council, composed mainly of his principal officers, which then held the chief power. Before his death he appointed his son Richard his successor, but he resigned the title and office a year after (April 22, 1659).

PROTEIDS, a name applied to a group of substances which form the chief part of the nitrogenous material of plants and animals. The proteids as a class very easily undergo change; they are not crystallizable, and hence it is very difficult to obtain them in a pure condition. Proteids contain the elements carbon, hydrogen, oxygen, sulphur, and nitrogen, and very generally phosphorus. The sulphur exists in an unoxidized state, the phosphorus probably as a phosphate. The proteids have been divided by Hoppe-Seyler into the following classes:—

(1.) *Albumina*. Soluble in water. Under this class are included egg-albumin and serum-albumin.

(2.) *Globulina*. Insoluble in water; soluble in very dilute acids and alkalies, also in dilute solutions of sodium chloride and other salts. In this class are included myosin, a substance prepared from fresh muscle; globulin, prepared from fresh blood-serum; fibrinogen, a substance which closely resembles globulin; and vitellin, which is prepared from the yolk of hens' eggs.

(3.) *Albuminates* are insoluble in water and in sodium chloride solution, but dissolved by dilute acids and alkalies. This class includes the two substances acid-albumin, obtained by adding a small quantity of dilute hydrochloric or acetic acid to egg-albumin, heating the liquid to 70°, and neutralizing the liquid; and alkali-albumin, prepared by treating egg-albumin with alkali, heating, and neutralizing with acid.

(4.) *Fibrin*. Insoluble in water; with difficulty soluble in dilute acids and in alkalies, and in neutral saline solutions. Fibrin may be prepared by stirring fresh blood with a twig; it has a filamentous structure, and is very elastic.

(5.) *Coagulated Proteid*. Prepared by heating egg or serum albumin; it is insoluble in water, dilute acids, alkalies, and neutral saline solutions.

(6.) *Amyloid*. This substance resembles coagulated albumin in its insolubility, but differs from it

in completely resisting the action of gastric juice. It is deposited in the liver in certain diseases.

(7.) *Peptones*. These substances, into which the other proteids are converted by the action of the gastric juice or pancreatic fluid, are characterized by their extreme solubility and ready diffusibility. See the article **PEPTONES**.

In the process of digestion it is probable that undigested proteids are converted into peptones; but as yet we possess no very definite knowledge concerning the mutual relations of the various proteid bodies.

PROTESILAUS, one of the Grecian heroes at Troy, was the son of Iphiclus, king of Phylace, in Thessaly, and of Astyoche. He is said not to have originally borne that name, but to have received it because he was the first of the Greeks who leaped ashore on their landing before Troy. It is said that he was immediately killed by a Trojan warrior, according to some by Hector. When his death became known to his wife, Laodamia, she is said to have begged the gods to allow her to converse with him once more for only three hours. They granted her request; and when at the end of the allotted time Protesilaus died for the second time, Laodamia died with him. This forms the subject of one of Wordsworth's finest poems. His tomb was near Eleus, on the Thracian Chersonese. He was honoured as a hero after his death. A temple was erected to him at his tomb, and funeral games were held in his honour at Phylace.

PROTEST, a solemn declaration of opinion, commonly against some act, particularly a formal and solemn declaration, in writing, of dissent from the proceedings of a legislative body, as a protest of the lords in Parliament, or a like declaration of dissent by a minority of any body against the proceedings of the majority. In commerce, a formal declaration, made by a notary public, under hand and seal, at the request of the payee or holder of a bill of exchange, for non-acceptance or non-payment of the same, protesting against the drawer and others concerned for the exchange, charges, damages, and interest. This protest is written on a copy of the bill of exchange, and notice is given to the drawer and endorsers of the same, by which they become liable to pay the amount of the bill, with charges, damages, and interest. (See **BILL OF EXCHANGE**.) A protest is also a writing, attested before a notary public, a justice of the peace, or a consul in foreign parts, drawn by a master of a vessel, stating the severity of a voyage by which the ship has suffered, and showing that the damage was not owing to the neglect or misconduct of the master.

PROTESTANTISM, in the Christian Church, a general name for the doctrines which arose in opposition to Roman Catholicism. This name, like many others in history, owes its origin to a circumstance comparatively insignificant. It originated in Germany, when those members of the empire who were attached to the Reformation protested (April 19, 1529), before the assembled princes, against the following resolve of the diet at Spire: 'That, until a general council should be held, further innovations in ecclesiastical affairs should be avoided; the mass should not be any further abolished, nor its celebration be prevented in those places whither the new doctrine had already spread; no inflammatory sermons should be preached; and no vituperative writings be printed.' The protesting members were the electors John of Saxony and George of Brandenburg, Princes Ernest and Francis of Brunswick-Lüneburg, Philip, landgrave of Hesse, and Wolfgang, prince of Anhalt, together with fourteen imperial cities, the chief of which were Strasburg, Nürnberg, Ulm, and Constance. In

consequence of this protestation they were called *Protestants*, and soon adopted this name themselves. The word *Protestant* was afterwards adopted also in other countries. In 1817, on the occasion of the tercentennial celebration of the beginning of the German reformation, the Prussian government prohibited (June 30, 1817) the further use of the term *Protestant* in the country, as being obsolete and unmeaning, since the Protestants did not any longer protest, and ordered the word *evangelical* to be substituted for it. The numberless sects which have sprung up among the seceders from Catholicism since the time of the Reformation, and which are comprehended under the name of Protestants, all agree (however different their opinions on some important points may be) in rejecting human authority in matters of religion, taking the Holy Scripture as the sole rule of their faith and life, and adhering to particular creeds only as expressing the convictions in which all their members agree. Even when they differ they are often distinguished from each other rather by faint shades than by bold lines of demarcation. See REFORMATION.

PROTEUS, according to the old Grecian mythology, a deified mortal, a soothsaying and wonder-working old man of the sea, who fed the flocks (seals) of Poseidōn (Neptune) in the Ægean Sea, and was said by wandering mariners to sun himself with his sea-calves, and to sleep at mid-day, sometimes on the desert island of Pharos, near the western mouth of the Nile, and sometimes on the opposite side of the Mediterranean, in Carpathus (the modern Scarpanto), between Crete and Rhodes. He prophesied only when compelled by force and art. He tried every means to elude those who consulted him, and changed himself, after the manner of the sea gods, into every shape, into beasts, trees, and even into fire and water. But whoever boldly held him fast to such a one he revealed whatever he wished to know, whether past, present, or future. Thus Menelaus surprised him (Odyssey, iv. 351), and compelled him to aid him by his prophecies and his counsel. Homer calls Proteus Egyptian, either in the literal sense or to signify that he lived in the neighbourhood of the river Egyptus. Later writers represented Proteus as a king in the time of the Trojan war, who, either by divine skill or by an artful change of the ornaments of his head, could assume various forms. According to other accounts, which, perhaps, Virgil had in view, Proteus was a deified sorcerer of Pallene, a peninsula of Emathia or Macedonia. Disturbed by the profligacy of his sons, he went, in the time of Heracles, under the sea to Egypt, and in that unfrequented part of the sea kept the sea-calves of his master Poseidōn, who had given him the wonderful power of prophesying. The later mystics made him an emblem of primeval matter, and he is thus represented in the twenty-fourth Orphic hymn. This mortal-born sea-god now became a son of Poseidōn and Phœnice, or of old Oceanus himself and Tethys. Psamathe was his wife, by whom he had many sons and daughters, whose names are differently given. Any one who hastily changes his principles is, from this old sea-god, called a *Proteus*.

PROTEUS, a remarkable genus of Amphibian Vertebrates allied to the Axolotls, Sirens, &c., and included in the order of Urodela or Tailed Amphibia. The Proteus further belongs to the section Amphipneusta or Perennibranchiata (which see) of that order, in which the gills, possessed by all Amphibia in early life, are retained throughout the entire lifetime of the animals, in addition to the lungs with which they are also latterly provided. The Proteus, therefore, represents one of the typical Amphibia, and breathes by both gills and lungs throughout its adult existence. These animals are confined to a very limited portion of the earth's surface, being found

only in the waters of certain subterranean caves in Central and Southern Europe—as, for example, in the caves of Central Austria, Illyria, and Dalmatia. The animal itself is about 12 inches long. Its body is elongated, slender, and somewhat cylindrical, and averages about 1 inch or $\frac{3}{4}$ of an inch in diameter. It is of a pale flesh tint—the absence of colour being the necessary result of its non-exposure to light. The tail is broad and compressed. The limbs are of very weak construction, the front legs possessing three, and the hinder limbs only two toes. Three pairs of bright red or scarlet branchiæ or gills project from the branchial clefts on each side of the neck, the bright colour of these external gills contrasting strongly with the otherwise colourless body. Two series of small teeth exist in the upper and in the lower jaw. The eyes are of rudimentary nature, and being completely covered by the skin are not functionally useful. The Proteus is eminently aquatic in its habits, and there is little doubt that the external gills constitute the chief agents in respiration, the elongated lungs with which it is provided being of very rudimentary structure. It swims easily; and in dry seasons, or when the water of the caves becomes dried up, the Proteus is said to bury itself in the mud, after the fashion of the African and American *Lepidosirens* or Mud-fishes (see DIPNOI); and in the latter case the breathing would become aerial, and be carried on by the lungs.

The single fully-defined species above described is the *Proteus* or *Hypochthon anguinus* (see the plate BATRACHIANS); but a few presumed varieties of this species have been also noted. Occasionally one of these varieties has been described as a distinct species under the designation of *Proteus xanthostictus*. The skin in all is smooth, and not invested by scales or hard structures. The caves of Adelsberg in the Duchy of Carinthia are among the best-known haunts of this singular form. The red blood corpuscles of the Proteus, it may lastly be noted, are the largest of any known Vertebrate animal, just as those of the Musk-deer (which see) are the smallest. They are oval in shape, nucleated, and measure each about $\frac{1}{177}$ th of an inch in diameter. The red blood corpuscles of man average $\frac{1}{277}$ th of an inch, those of the massive Elephant $\frac{1}{274}$ th, and those of the Whale $\frac{1}{275}$ th of an inch in diameter. It will be readily seen from these measurements how greatly the blood corpuscles of the Proteus surpass those of the larger animals in size.

PROTOCOL (from the Greek *prōtos*, first, and *kolla*, glue), originally, in legal instruments, the first sheet glued to the *scapus* or cylinder round which the instruments were rolled. On it were stated the date at which the instrument was drawn up, the names of the persons who drew it up, and a number of other particulars, which served to identify the document. The word has since acquired a variety of other significations, the origin of which it is not in all cases easy to discover. In the language of diplomacy it signifies sometimes the rough draught or the original copy of any instrument, and sometimes the minutes of the deliberations and proceedings of a congress, diet, or conference. In France the term is applied to a book containing the prescribed formulas for instruments accompanying certain transactions, and also to the formulary prescribing the manner in which sovereigns, princes, and heads of departments should address those to whom they write. In Scotland a book was formerly kept under the name of protocol by every notary, for the insertion of copies of all the instruments he might have occasion to draw up. These protocols were intended to serve as records of sines, and when they were regularly kept were allowed to supply the place of lost documents; but they seldom were so kept.

PROTOGENES, a Greek painter, contemporary with Apelles, born at Caunus in Caria. He flourished between 382 and 300 B.C. Several masterpieces of his are mentioned, particularly a picture of Ialysus, a mythical hero, said to have been the founder of the city of that name in the Island of Rhodes. In this picture a hound was represented panting, and with froth on his mouth. Pliny relates that for a long time the painter was unable to satisfy himself in the execution of the froth; but that at last, in a fit of anger, he threw the sponge with which he used to wipe off the colours on the painting, and thus accidentally produced a natural representation of it. This picture saved the city of Rhodes when it was besieged by Demetrius Poliorcetes, who refrained from making his attack on the weakest part of the city because the picture was placed there, and he feared to injure it. During the siege Protophenes, who lived outside the walls of the town in the midst of the besiegers, is said to have been specially cared for by Demetrius, who frequently visited him and attentively watched the progress of his works, which the painter continued undisturbed amid all the din of the siege. Protophenes is said to have lived in comparative obscurity at Rhodes till the fiftieth year of his age, when his merits were made known to his fellow-citizens through a visit of the equally or even more distinguished painter Apelles. The manner in which the two great artists introduced themselves to one another forms the subject of a celebrated story, which will be found in our article on **APELLES**. The means which Apelles took to let the Rhodians understand how great a painter they had amongst them was to offer Protophenes the enormous sum of 50 talents for each of his works, which the painter himself had been in the habit of selling for very insignificant sums. The Rhodians thus enlightened, it is said, now wished to buy back the pictures from Apelles, in order that they might keep them among themselves, and Apelles refused to part with them except on getting an advance on the price that he had himself paid. It was probably after this visit of Apelles to Rhodes that Protophenes went to Athens, where he executed one of his finest pictures in the Propylæa. In the time of Cicero it was still in that city, but Cassius carried it to Rome, and placed it in the Temple of Peace, in which it was burned during the reign of Commodus. Quintilian records that Protophenes was remarkable above all painters of the best period for the careful finish of his pictures.

PROTOPLASM (*protos*, first or primitive; *plasso*, I mould), the name applied to the elementary or primitive organic compound of albuminous nature, which enters into the composition of organized tissues of all kinds. The term is more specially used to denote the substance—indistinguishable from the primitive base of the tissues in higher forms—of which the bodies of the lowest animals or *Protozoa* (which see) and the lower plants or *Protophyta* are wholly composed. The body of an *Amœba*, the living portion of the *Foraminiferous* animalcule, or the organism constituting one of the low *Confervoid* plants, thus consists simply of a microscopic particle of an albuminous jelly-like matter. This matter is known as *protoplasm*, and the names *sarcode* and *bioplasm* have also been applied to it, and have been, therefore, used synonymously with the first-mentioned term. It is to be clearly noted, that no appreciable difference either of chemical or microscopical kind is to be perceived between the protoplasm of the lower forms of life and that out of which the tissues of the highest animals are elaborated, and of which in their primitive or embryonic state they were entirely composed. This protoplasm, therefore, enters into the intimate composi-

tion and formation of animal and plant tissues of every kind. It forms the indispensable medium, as it were, and at first sight, for the presence and manifestation of vitality. The tissues of the highest plant or animal form may be considered simply as consisting of elaborated protoplasm, equally as the body of the lower animalcule or plant consists of that substance in a more primitive and undifferentiated state. The difference, in short, between the protoplasm of different organisms is not one of kind, but merely one of the degree to which, through processes of development, it has become elaborated and organized.

The recognition of this universality of a protoplasmic basis or stratum in living organisms founded a most important era in biological science. And hence the term 'physical basis of life,' sometimes applied to this substance, has arisen from a conception that protoplasm, in some more intimate manner than might be generally conceived, is related to the mysterious assemblage of actions and processes to which the terms *living* or *vital* are applied. As we shall hereafter notice, however, the relations of protoplasm to vital or living force are susceptible of different and more feasible explanation than is involved in the above idea, which formed the germ of a theory of vital action attaining a high celebrity of late years.

In its chemical composition protoplasm exhibits carbon, hydrogen, oxygen, and nitrogen united to form one of a group of proximate compounds to which Mulder gave the name of 'proteine' compounds. These compounds, it must be remembered, are essentially of an *albuminous* nature, and the chemical composition of the varied forms of this protoplasmic material is wonderfully constant, although the results of its organization and development may, as already stated, vary in the greatest degree. The other constant physical conditions or characters exhibited by protoplasm may be summed up by stating that this substance undergoes contraction when electric currents are sent through it; and further, that at a temperature of from 40° to 50° (Centigrade; 104° to 122° Fahr.) it coagulates or undergoes the changes implied under the term 'heat-stiffening.'

That protoplasm, however much in mere chemical characters it may resemble other forms of albumen, differs widely from these substances in its relations to life and vitality, cannot be questioned. It thus differs from mere albumen, not only in its power of exhibiting contractility, and in its possessing the power of independent growth, but also, and more strongly, in the fact that of itself (as seen in many animalcules) a minute fragment of protoplasm may constitute a complete living being. And such a minute organism, destitute of all definite or appreciable organization, may live, nourish itself, reproduce itself, and, in short, perform all the functions of vitality as perfectly, so far as its own immediate life is concerned, as the highest animal or plant.

The next point that naturally presents itself for determination is as to the relations in which this protoplasm stands to life and vital force, or in which it becomes so marvellously associated with vital properties. A view, enunciated by Huxley, and supported by many eminent biologists, assumed that life was a property of this protoplasm or sarcode substance. They held that as it was unquestionably proved that life was invariably found to be associated with protoplasm it might reasonably be concluded that life or vitality resulted from the combination of the chemical elements of the protoplasm and in virtue of any other physical or physico-chemical conditions which resulted from that combination. Such a theory may therefore be termed a purely *physical* theory of life, in opposition to a second

hypothesis, which receives the name of the theory of a *vital force*. This second theory or view maintains that, admitting the universality of a protoplasmic basis for living beings, it is nevertheless more philosophical to conclude that, firstly, life is not a mere property of protoplasm; that, secondly, as it cannot be determined whether vitality or the formation of protoplasm precede each other in point of time, it is more reasonable to conclude that life precedes its sarcodic basis, and may therefore as justly be assumed to be the actual *cause* of protoplasm formation; and that, thirdly, since neither chemical nor physical science has been able to demonstrate the nature of or to produce any approach to the living or vital forces characteristic of living beings, such forces cannot be assumed to be of physical origin or to depend for their inauguration or maintenance on purely physical conditions.

These opposing theories are to a certain extent still prevalent and in existence in modern biology, the question of the evolution of living beings possessing an intimate relation to the evolution of life itself, having therefore served to stimulate the progress of the first-mentioned or physical hypothesis. The argument which has been used in support of this physical theory has been illustrated by such metaphors as the following. Water, it is argued, consists of two gases, hydrogen and oxygen. If these gases be therefore combined in certain proportions they form water, and all the properties of water, exhibited under its fluid, gaseous, or solid states, are simply said to 'result from the properties of the component parts of the water.' It is hence urged that as we do not assume that a something called 'aquosity' entered into and took possession of the water, and directed the exhibition of its properties, so neither are we entitled to assume that a something termed 'life,' 'vital force,' or 'vitality' is inherent in and directs the operations of living beings.

This argument, however, is not susceptible of strict practical or even logical application to the merits of the opposing theories. The comparison of the production of water by bringing oxygen and hydrogen together, and the production of vitality by the union of protoplasmic elements, is not a strict parallelism, if it may indeed be deemed a parallelism at all. The elements of water combine with one another in virtue of the ascertained laws of chemical affinity, and we require no new force (or aquosity) to account either for the formation of water or for the exhibition of its properties. In the case of protoplasm we have invariably to assume the existence of some additional force or property which mere chemical or physical laws and conditions can neither produce nor explain. A protoplasmic compound might be artificially manufactured in the laboratory of the chemist by forcing its elements together, but would such a compound exhibit the phenomena and actions characteristic of the humblest piece of *living* protoplasm? The reply is an obvious negative; and it is exactly this superadded something which the vitalist terms life or vital force that defines the dead from the living protoplasm. We require, in short, the existence and operation of new and independent conditions and forces to make the protoplasm *live* in the sense that even the lowest organism lives, since the highest art of the chemist can never attain to the manufacture of *living* protoplasm. And if the forces or conditions, in virtue of which protoplasm lives, are inexplicable by, and without the boundary of chemical or physical science, then it is illogical either to deny their existence or to refuse to assign to them any recognition or place or name in the category of operating influences in the living organism. 'Vitality' has thus a definite status; the 'aquosity' of the physical theorist has no status at all.

VOL. XI.

Life is thus to be viewed certainly not as a mere quality or property of protoplasm but as an independent principle investing the sarcodic matter with all the wondrous actions which we know living matter to possess. Modern science may indeed be unable yet to determine the relations of this living principle or vital force, and this inability to explain these relations has been put forward by the physicists as a point against the logical nature of the theory of vital force. But it is not too much to say that the exact nature of life may remain to us as much a mystery in all future time as it has been from the far back past; and it must not be forgotten that science is by no means always equal to the full discovery of new fields of thought or even to the due appreciation of such as have been discovered. Electricity and magnetism have been comparatively recently studied, but the full appreciation of these forces has yet to be attained. Because, therefore, we are unable to reduce the relations of vital force to mathematical accuracy, and because we cannot even primarily determine these relations, we are not on that account entitled to assume the non-existence of the force. And hence the question at present stands as involving speculations and researches not only of the deepest kind, but such as lead us from the known and finite into the domain of the infinite and unknowable.

What *life* really is we therefore in the present state of our knowledge cannot tell, and we may never be equal to the task of the full and perfect elucidation of the intimate causes and conditions of vital action; but enough will already have been said to show that the causes of vital action are not purely physical, and that its conditions are not susceptible of explanation according to ordinary chemico-physical or mathematical laws. Protoplasm thus viewed becomes the inseparable and invariable *medium* for the exhibition of vitality. In no sense can we assume that medium to represent vitality itself. See also ORGANIZATION, PROTOZOA, &c.

PROTORNIS, a genus of fossil birds, represented by a single species, the *Protornis Glaricensis*, found in the Eocene schists of Glaris in Switzerland. This bird is the oldest fossil representative of the order of Insectores (which see) or Perching Birds. It appears to have most nearly resembled existing Larks in size and structure. The *Halcyornis toliapicus* of the London clay (Lower Eocene) of Sheppey is another early fossil form of the Insectores, this latter bird being most nearly allied to the Kingfishers.

PROTOZOA (Greek, *prōtos*, first; *zōon*, an animal), the name applied to the lowest sub-kingdom or primary division of the animal world. This group is represented by such forms as the Infusorial Animalcules, Amœbæ, Foraminifera, and allied organisms, &c. Within the limits of this division a great number of organisms were formerly included, which the improvement of biological science, and especially the advance of microscopical research, showed were not entitled to be structurally classified with the Protozoa. As the group at present stands, however, it still includes several forms or even limited groups of organisms, concerning the exact nature of which naturalists are by no means agreed. This latter fact is to be viewed simply as the result of the great difficulty experienced in definitely deciding the exact animal or plant nature of many organisms. And seeing that it is in the lower confines of the animal and plant worlds that the two great kingdoms of living nature merge insensibly into one another; and further, that biological science is as yet unequal to the task of definitely separating animals from plants, it is not surprising that many of the Protozoa and Protophyta are regarded as belonging to a neutral ground, rather than as finding a definite place in

either the animal or the plant world. Indeed, so hopeless and confusing has the task of separating the lower animals from the lower plants been considered, that Professor Hæckel has proposed to constitute a third kingdom or division, intermediate in nature between the animal and plant worlds, and into which all organisms concerning the position or nature of which any doubt could be entertained might be temporarily deposited or classified. For such an intermediate division, partaking of the nature of 'a biological No Man's Land,' as Huxley terms it, the name of *Regnum Protisticum* was proposed. But the scheme has not met with the approval of naturalists generally, since the further task of separating out and arranging the denizens of this intermediate kingdom would form a labour of greater difficulty than that included in the trying to assign organisms at once and simply to either animal or plant world. The difficulty, in other words, at first single, is simply doubled by the adoption of Hæckel's plan.

Bearing these considerations in mind, as absolutely necessary to the clear understanding of the limits of the sub-kingdom Protozoa, the characters or chief characteristics of the group may firstly be enumerated. No definite or positive characters can be given of this sub-kingdom. We rather distinguish its included members by their negative features, that is, by their want of the definite characters which other sub-kingdoms possess. The first character may therefore be stated to consist in the entire *absence of a nervous system and of organs of sense*. No perfect *digestive system* is specialized or differentiated. No *symmetry* or definite plan of body-structure can be ascertained to exist in Protozoa, and there is thus an utter want of the elementary or segmental parts to be discerned in other animal forms. No body-cavity or internal space exists. The bodies of Protozoa are composed of an albuminous substance, termed *sarcode* or *protoplasm* (see PROTOPLASM), this matter existing in this group of animals in its simplest and most primitive condition. In the bodies of most Protozoa a minute solid particle termed the *nucleus* (see NUCLEUS) may be discerned, and the nucleus may in its turn frequently contain a smaller particle known as the *nucleolus*. The functions of the nucleus and nucleolus have been considered to be closely related with certain forms of the reproductive processes in these forms. *Reproduction* takes place generally by asexual methods, such as *fission* or simple division of the body-substance, and by *gemmation* or budding; but in some cases (for example, Gregarinida) phenomena closely imitating those seen in the sexual reproduction and ovular development of higher forms have been observed.

The Protozoa are, with very few exceptions, *aquatic* in their habits, and occur in both fresh and salt waters; the Gregarinida, &c., although parasitic at one stage, being aquatic in other stages of their existence. They are usually of minute and microscopic size, the Sponges and a few other organisms presenting the most familiar exceptions to this rule.

The nature of the protoplasmic substance, of which the bodies of the Protozoa are composed, has already been considered in the article on PROTOPLASM. Nothing more need therefore be said of this substance, or of its relations to the living or vital force, save to remark that it forms a typical albuminous compound, generally semi-fluid in its nature; and consists of an albuminous basis, containing oil-globules and minute solid particles or *granules*, in addition to the better-defined *nucleus*. It possesses inherent powers of growth and contractility, and may evince of itself all the functions and characteristics associated with the possession of life, and the maintenance of the vital state. Many of the Protozoa are nothing more than

mere minute specks of this protoplasm, which may thus constitute without further elaboration a true and perfect living being of lowly kind. It is probable, as stated in the article on PROTOPLASM, that this substance acts as a universal medium or basis for the exhibition of that peculiar force or condition, not explicable according to chemical or physical laws, and to which we give the name of *vital force* or *life*.

The Protozoa move about in various ways. Locomotion may thus be performed by simple contractions of the protoplasmic bodies, or by the extension from these bodies of prolongations of the sarcode substance (seen in *Amœba*, &c.), known as *pseudopodia*. In other cases, such as in Infusoria, movements are executed by means of minute vibratile filaments, which, from their resemblance to miniature eyelashes, have been termed *cilia*. These cilia occur in very many other groups of the animal world, and they appear to be endowed with the power of independent motion. They thus move freely with a waving motion, the microscope being unable to determine any structural apparatus or means whereby their movements are executed. Occasionally, as in some Infusoria, the numerous cilia may be replaced by a single large lash-like appendage, known as a *flagellum*, and by means of the movements of this structure the little organisms propel themselves through the water. The currents created by the cilia are frequently used to attract food-particles to the mouth or oral aperture, in addition to the function of locomotion.

The Protozoa may be primarily divided by the absence or presence of a mouth or oral aperture into two main or primary divisions. The first of these includes those Protozoa which are destitute of a distinct mouth, and this group has been accordingly named *Astomata* or *Astomatous* Protozoa. The second primary division, or *Stomata*, includes those in which a distinct aperture for the reception of food exists. Various arrangements of the groups included under these heads will be found detailed in zoological works; one author combining two groups, such as the Rhizopods and Sponges, to form one class, which another authority would decide should be kept as distinct and more definite divisions. The simplest classification divides the Protozoa into four chief classes. These are the *Gregarinida*, *Rhizopoda*, *Spongida*, and *Infusoria*. The first three of these will fall under the *Astomatous* division, as not possessing a distinct mouth; the Infusoria or highest class of itself constituting the *Stomatous* group, as possessing a definite oral aperture. In recent classifications, it must be remarked, the Sponges (Porifera) are generally excluded from the Protozoa and placed among the Metazoa (the division which includes all animals higher than Protozoa) as showing a substantial differentiation of parts and specialization of functions.

Class I. *Gregarinida* (Latin, *gregarius*, occurring in numbers). The members of this group, first defined by Dufour, are defined as parasitic Protozoa, destitute of a mouth, and which do not possess the power of emitting *pseudopodia* or processes of the body-substance, as seen in the next class, that of the Rhizopoda. The typical genus *Gregarina* represents this class. The Gregarinae occur as minute parasites, inhabiting the alimentary canal of certain insects (for example, Cockroach) and other Annulosa, but occurring in Vertebrates also. The body of a typical Gregarina might be described as consisting of a little fusiform or somewhat ovoid mass of protoplasm, bounded by an ill-defined wall or envelope-membrane. The protoplasm is granular in its characters, and usually contains a nucleus and nucleolus. In actual size these organisms vary from that of the head of a small pin to $\frac{1}{4}$ inch in length, or even more. The body-substance may be uniform and undivided

in character, or it may present the appearance of being internally divided in various ways; and on these appearances, as will be presently noticed, a classification of the group by Stein has been founded. Occasionally one extremity of the body may be provided with hooked processes, by means of which these organisms can attach themselves to the digestive tract of their hosts. No traces of digestive, circulatory, or nervous centres can be perceived. Nutrition is effected by the simple imbibition of the fluids of their hosts. The Gregarinæ appear to be able to effect certain slow, ill-defined movements of their colourless bodies.

Reproduction takes place after a method which would appear to imitate closely the process of true development, as it occurs in the impregnated eggs of higher animals. Two Gregarinæ may thus be observed to coalesce, or the changes to be described may take place, in some species, in a single and individual Gregarina. And around the two Gregarinæ, or the single Gregarina, as the case may be, a cyst or wall soon develops. The mass then becomes motionless, and of a spherical form. The nucleus and nucleolus next disappear, and the contents or interior of the cyst become divided and subdivided (very much after the fashion of the segmentation of the yolk in the egg of higher animals) until the entire mass within the cyst is broken up into a great number of minute spindle-shaped bodies, to which the name of *pseudonavicellæ* is given. The cyst next ruptures or bursts, and the pseudonavicellæ escape. If they obtain a congenial habitat, such as amongst water, they appear each to develop into little amoeboid masses of protoplasm, possessing the power of shooting out their bodies into processes, and otherwise resembling the Rhizopodous organisms hereafter to be described under the name of *Amœbe*. A few additional changes, mainly devoted to the consolidation of the body, and to the assumption of the mature form, suffices to change each pseudonavicella into a young Gregarina. These gaining admittance, either before or after their pseudonavicular state, to the bodies of their characteristic hosts, repeat the strange reproductive history thus chronicled.

The Gregarinæ thus evince, each in its mature structure, the form and characters of a simple cell, and the developmental process in these forms bears a strong analogy, if not a still more intimate relation, to that of the development of the true impregnated eggs of other animals.

Various species of these animals are known. The *Gregarina* of the Common Earthworm is a familiar species, and *G. sanuridis*, and *G. Sipunculi*, *G. Sieboldii* are also known. *G. gigantea* of the Lobster attains a comparatively large size; and its pseudonavicellæ are exceedingly like *Amœbæ*, and give off each two detached processes, which move about independently of the pseudonavicella itself. Stein has divided the class Gregarinida into the (a) *Monocryntideæ*, or those without constrictions or internal partitions or septa; (b) *Gregarinaria*, those with the body divided into two portions; and (c) *Didimophydeæ*, those with the body divided into three parts, as if one Gregarina from each of the other two sections had coalesced. These organisms have been variously regarded as larval Annuloida, as vegetable forms, and by Hæckel as *Amœbæ* degenerated for a parasitic life.

Certain peculiar little hemispherical or oval bodies, known as *Psorospermia*, found on and within the bodies of fishes, are generally regarded as being most nearly related to the members of the present class, and as being identical with free pseudonavicellæ of Gregarinæ (Lieberkuhn). By Balbiani they are regarded rather as plant-organisms. See also PARASITES.

Class II. *Rhizopoda* ('root-footed'). The Rhizopodous Protozoa are defined as those destitute of a mouth, and which possess the power of emitting processes of their body-substance, termed *pseudopodia*. This latter power has gained for them the distinctive term of 'Root-footed' Protozoa. These forms may be either simple or compound. The *Amœba* (see the accompanying plate, fig. 30), an organism common in all our fresh water ponds and ditches, may be selected as a very familiar representative of this class. It exists as a microscopic mass of protoplasm, which, when placed under the microscope, exhibits curious movements of its protoplasmic body. It may thus be seen to push its body out into finger-like processes, or *pseudopodia*, and by means of these to move about, or to grasp particles of food. These processes can be usually protruded from any portion of its body, and are freely pushed out, and as freely withdrawn again into, or merged with the general sarcode-matter of the body. It thus continually evinces alterations of the shape of its body, and from this fact received its former name of *Proteus*-animalcule; this latter term being, however, discarded for its present name of *Amœba*. Within the body of the *Amœba* a nucleus and nucleolus are usually to be perceived, and certain clear spaces, termed *contractile vesicles*, may also be noticed. These spaces are so named from their exhibiting rhythmical movements of contraction and dilation, resembling thus the movements of a circulatory organ or heart; and the function of distributing fluid throughout the protoplasmic body has been theoretically assigned to these vesicles, although the actual demonstration of the function has not been attained.

The protoplasm of the *Amœba*'s body exhibits a differentiation into layers; the outer and firmer layer being termed the *ectosarc*, and the inner and more fluid one the *endosarc*. The nucleus and contractile vesicles are contained within the *endosarc*, the *ectosarc* mainly giving origin to the pseudopodia. Food seized by means of the pseudopodial processes is engulfed within the soft sarcode body and by any portion of its surface, no distinct mouth being found. The apertures by which food is taken in close up immediately after the intussusception of the nutriment. A clear space forms around each food-particle after it has been received into the sarcode-body, and the particle, if digestible, is slowly dissolved; the clear spaces left for a short time after the digestion of food in this way being termed *food-vacuoles*. It is needless to remark that the temporary food-vacuoles are not to be confounded with the permanent contractile vesicles, which latter form definite parts of the organization of the *Amœba*. It is doubtful whether or not any definite outer cuticle or membranous envelope surrounds and invests the *ectosarc* of the *Amœba*'s body. Effete matters and indigestible products are simply ejected from the body by any part of its surface: a temporary vent being thus formed similarly to the temporary mouth. In some cases a certain portion of the body, named the *pillous region*, has been said to be more definitely assigned to the function of ejecting effete matters. No traces of a nervous centre or of sensory organs exist, and locomotion is effected by the pseudopodial filaments.

Reproduction may be observed by a simple process of *fission*, whereby an *Amœba* may simply divide into two portions, each of which becomes a distinct and separate animalcule; or a single pseudopodium may detach itself from the parent-body, and by a process of growth develop into a mature *Amœba*. A process of generation allied to that described in Gregarina also occurs in *Amœba* and its allies. The body thus becomes cystiform, and segmentation or division of its internal portion produces little masses

corresponding to pseudonavicellæ, which develop into Amœbæ on their liberation by the rupture of the parent-cyst. It is, however, to be also borne in mind that several other Protozoa, and also higher animals, and even several lower plants, in their development produce Amœboid masses. These masses, however, are simply Amœba-like, and have no relation to the true and definite animalcule which has just been described.

Such is a description of a typical member of the class Rhizopoda. The classification of this group is generally arranged so as to include either two or three orders; but authorities such as Schultze and D'Orbigny have greatly extended in number the subdivisions of the group. Schultze classifies the Rhizopods into two chief divisions, with subdivisions as follows:—

- A. *Nuda* or Naked Rhizopoda. Example, Amœba.
- B. *Testacea* or shelled forms.
 1. Monothalamia—Single-chambered Foraminifera.
 2. Polythalamia—Many-chambered Foraminifera.
 - (a) *Helicoidea*: segments of shell arranged in a convolute series.
 - (b) *Rhabdoidea*: segments arranged in a straight line.
 - (c) *Soroidea*: segments arranged in an irregular manner.

The simpler mode of arranging the class Rhizopoda is to divide it into three or four orders. The first order, *Monera*, is of somewhat provisional and temporary nature, and was proposed by Hæckel as the name of a division including certain low organisms of doubtful nature, the bodies of which are composed of structureless protoplasm, and which possess no nuclei or contractile vesicles. The pseudopodia further exist as delicate interlacing filaments. No shell or test is developed, and the body, although capable of changing its shape, as in Amœba, is mostly circular or spherical in form. Reproduction takes place usually by fission. All *Monera* are inhabitants of the sea.

The second order, that of the *Amœbæ*, includes the genus Amœba and its allies, which are distinguished by their bodies being unprotected by a hard test or shell, or they may be invested by a membranous envelope or *carapace*, which may (as in *Diffugia*) be strengthened by having particles of sand imbedded in it. The pseudopodia in this order are short and blunt, and do not unite with each other. A nucleus and contractile vesicles are present. Of the genus Amœba several distinct species have been described. Amœba *radiosa* and A. *princeps* are two familiar forms; and in the sarcode of A. *bilimbosa* of Auerbach starch granules have been discovered. In the genus *Diffugia*, of which D. *proteiformis* may be selected as an example, an oval carapace exists, the pseudopodia being protruded from its upper or terminal aperture, and these forms thus creep about on their pseudopodia bearing the carapace uppermost. In the genus *Arcella* the carapace is hemispherical in shape, and its margin may bear spinous processes. The aperture through which the pseudopodia are emitted in *Arcella* exists on the flat surface of the hemispherical carapace. *Arcella acuminata* is a familiar species of this genus. In *Pamphagus* (Bailey) no carapace exists, but the body-envelope is of firm nature, and allows the pseudopodia to be protruded from one extremity of the body only. This animalcule (*P. mutabilis*) undergoes great changes in form, from its habit of throwing its soft sarcode-body around all objects with which it comes in contact, as if to swallow or engulf them. The genus *Actinophrys* contains the familiar 'Sun Animalcule' (*A. sol*), so named from the radiating manner in which the pseudopodia are given off from the spherical body, which averages $\frac{1}{100}$ of an inch in diameter. The order Amœbæ has thus been divided

into two sub-orders—*Amœbina*, including those in which the body is naked, as in Amœba; and *Arcellina*, in which (as in *Diffugia*, &c.), the body is contained within a carapace.

The *Foraminifera* form the third order of the class Rhizopoda. In these organisms the body is inclosed within a *calcareous* or *limy* shell or test. The sarcode of the body is not divisible into ectosarc and endosarc, as in Amœbæ, and no nuclei or contractile vesicles are present. The pseudopodia are elongated and interlace with each other, and from this latter fact Dr. Carpenter has applied the name *Reticulosa* to the group. These organisms are marine, and are found distributed in all seas, and especially in the oceans of tropical regions. In modern sea-beds these organisms form a thick layer of organic deposit, which tends, as in past ages, to consolidate into a chalk-formation. The term *Foraminifera* is derived from the presence in the shell-walls of minute apertures or *foramina*, through which the pseudopodia are protruded. The sarcode-matter of the bodies of these organisms appears to be of a more primitive kind than in other Protozoa; and it may be red or yellowish in colour. Through the network-like conformation of the pseudopodia a 'cyclosis' or circulation of granules is carried on. The shells—and consequently the *living* portion also of the bodies of Foraminifera—exhibit a division into two groups—the *Monothalamia* or 'single-chambered,' and the *Polythalamia* or 'many-chambered' forms. The many-chambered forms are originally and at first single-chambered, and are produced by a process of budding or gemmation, which, according to its direction, may develop various shapes of shell. By budding in a straight line a shell such as that of *Nodosaria* is produced. And similarly if new segments are added to the shell in a spiral manner, we have produced *nautiloid* or *trochoid* shells; or those of a more irregular form, as in *Globigerina* (fig. 23), or *Textularia* (fig. 24). The various loculi or chambers of a compound shell communicate with each other by apertures; so as to render the sarcode or living matter continuous throughout. In some forms a system of branching tubes has been detected in the walls of the shell, the function of these tubes being supposed to be that of bringing the parts of the shell and sarcode into closer relation. In some forms the shell may simply be arenaceous, or composed of particles of sand united by a membrane, as already seen in *Diffugia*. In others the shell is said to be porcellaneous or opaque-white, and not perforated for the pseudopodia, which (as in *Miliola*), are protruded from one extremity only. The vitreous shells are transparent and glassy, and numerous foramina exist in their walls.

As already remarked the Foraminifera are classified in various ways. Dr. Carpenter divides them into the *Imperforata*, in which the shells are membranous or calcareous and imperforate, the pseudopodia being emitted from one extremity only. This group includes the families Gromida (with membranous shells), Miliolida (with porcellaneous shells), and Lituolida (with arenaceous shells). The *Perforata*, or second group, includes those Foraminifera in which the shell is vitreous, or rarely arenaceous, and perforated for the protrusion of the pseudopodia.

Of *Monothalamous* forms *Lagena*, *Gromia*, *Entosolenia*, &c., may be selected as examples; the *Polythalamia* being represented by *Nodosaria*, *Discorbina* (fig. 22), *Globigerina* (fig. 23), *Textularia* (fig. 24), *Polystomella*, *Nummulites*, &c.

The *Radiolaria* forms the fourth and concluding order of the Rhizopodous class. These organisms possess shells, tests, or spines of siliceous or flinty matter, and their pseudopodia appear as radiating

filaments which sometimes interlace. An ectosarc and endosarc are generally to be distinguished in the sarcode-matter of their bodies. The *Acanthometra* of J. Müller form the first family or group of this order, the shells of these organisms consisting of a framework of hollow silicious spines, which emit some of the pseudopodia. These forms are all marine, and of microscopic size, being found floating on the surface of the ocean in large numbers. *Acanthometra lanceolata* is a familiar example of this division. They appear to possess no locomotive powers. The second Radiolarian group, that of the *Thalassicollidae* of Huxley, includes forms which may be simple or compound in structure. They are abundant in most seas, and do not possess great or any power of motion. They are found floating near the surface of the water, and in size vary from 1 inch to much smaller dimensions. The body consists of sarcode, imbedded in which are a number of cellular bodies, each of which consists of an outer membrane containing granular matter and a nucleus. The sarcode matter itself surrounds a large inner cavity or space. No contractile vesicles exist. The shell may consist of a number of delicate spicula, or of a network-like arrangement of silicious spines. *Sphaerocum punctatum* is a familiar form; as also is *Thalassicolla nucleata*. In *Collosphera*, the third typical genus, a transparent, brittle, silicious envelope exists. All the members of this group are marine.

The *Polycystina* are described under the article of that name. They possess beautiful regular shells composed of flint. *Haliomma* (fig. 29) and *Podocystis* are typical genera.

Bathybius (fig. 31) is an anomalous form, presumably of Protozoan kind, consisting of a mass of sarcode of undefined form, and having imbedded within this mass little calcareous bodies known as *coccoliths*, which latter are sometimes united to form spherical masses termed *coccospheres*. These coccoliths have long been known as attaching themselves to Foraminiferous shells. They are alleged by Carter to be simply unicellular calcareous Algae, or sea-weeds of a low type of organization; the coccospheres being the sporangia or spore-cases of these forms. In this view the association of these bodies with *Bathybius* is regarded as merely of an accidental kind. And doubts are now entertained as to whether *Bathybius* itself is not of inanimate nature.

Class III. Spongida. This group includes the sponges, the exact nature of which was for long a puzzle to naturalists, but which by almost universal consent are now included in the animal world. Several authorities, however, still appear to think that these organisms are more nearly allied to the vegetable kingdom, but a review of their life-history clearly shows their truly animal nature. The present class may be defined as including organisms composed of sarcode-bodies or particles not possessing a distinct mouth, and which form compound masses. This mass is generally supported either by a skeleton of horny fibres, or by one of limy or flinty spicula. And the entire organism is perforated by a system of canals opening on the surface. A sponge is therefore to be viewed as a compound organism rather than as a single animal form; and in the nutrition, as well as the development and reproduction of this class many interesting features are to be noted. See **SPONGE**.

Class IV. Infusoria. The members of this class are so named from their occurring in infusions of animal and vegetable matter which have been exposed to the air. They form the highest organisms of the Protozoa. They are defined as possessing a mouth, and a rudimentary digestive cavity. They do not

possess the power of emitting pseudopodia; and locomotion is performed by means of *vibratile cilia*. They are all of minute size, and the sarcode-matter of their bodies is divisible into three layers. Illustrations of this class may be found in the plate, figs. 13, 14, 15, 16, 17, 18, 19, 20, 21, &c. The chief features in the morphology of the group may be seen in such a form as the *Stentor* (fig. 17) or 'Trumpet-Animalcule;' or in *Vorticellæ*, *Zoothamnium* (fig. 18), and other stalked forms, &c. The body is composed externally of a transparent skin or pellicle, named the *cuticle* or *cuticular layer*, within which a layer of firm sarcode exists known as the *parenchyma* of the body or *cortical layer*. The third or central layer is soft, and of more fluid consistence, and is named the *chyme-mass* or *abdominal layer*. The cuticle is fringed by vibratile cilia, by means of which locomotion is effected, and currents created in the water for the purpose of drawing food-particles towards the mouth. This latter aperture opens into the cuticle, and is continued into a gullet-like tube, which, however, does not lead into any stomach, but simply merges into the general protoplasm of the central part of the body. The cortical layer contains the nucleus and contractile vesicles. The nucleus is generally elongated, and possesses a nucleolus either attached to its external surface, or imbedded in its substance. The functions of the contractile vesicles are thought (as in *Amæba*) to be those of a circulatory apparatus, and as if in support of this view, tubular canals have been traced passing from these vesicles into the internal parts of the body. Whether or not these vesicles communicate with the external medium, or what is the nature of the fluid circulated by them, are points still undetermined. The food-particles, swept into the mouth, pass down the gullet, and are indiscriminately lodged in the general protoplasm of the body. Around each food particle a clear space or vacuole forms, as in *Amæba*, and the presence of these vacuoles led Ehrenberg to suppose that these animalcules possessed a number of stomachs or digestive sacs—a belief which led him to name this class *Polygastrica*. It has, however, been definitely ascertained that no digestive sacs exist, and that the food vacuoles are merely of temporary duration and nature, and that food may be, and is, digested by any portion of the sarcode-body. Indigestible matters in some cases appear to be expelled by an aperture placed near to the mouth.

The *nucleus* is viewed as corresponding to the ovary or female generative apparatus, and the nucleolus as a *testis* or male organ. Reproduction may be effected by fission or simple division of the body-substance, by gemmation, or budding; or by processes analogous to sexual generation in higher animals. A process of *conjugation* has been observed to occur in some forms (for example, *Paramæcium*), in which transference of the nucleoli takes place between two forms; a development of germs succeeding within the bodies of the conjugating animalcules. These germs being liberated develop into adult Infusoria. In others a process of *encystation* occurs; the animalcules becoming cyst-like (as in *Gregarina* and *Amæba*), and a division of the nucleus or body-content taking place. The rupture of the cyst-like parents gives origin to the little particles or germs therein produced, and the latter develop in turn into adult animalcules. This process is well seen in the stalked *Vorticellæ*.

These forms are classified in three orders. In the first of these, named *Ciliata*, and which includes the great bulk of Infusorian forms, the vibratile cilia are disposed more or less plentifully over the outer layer of the body. Some are also provided with jointed bristles or styles, or with little hooked processes termed *uncini*. Of this group the free-

swimming *Paramecium*, or Slipper-Animalcule; *Bursaria*, *Aspidisca*, the stalked *Vorticellæ*; *Epistylis*; and *Carchesium*; the *Stentor*, sometimes free, sometimes attached; and many others may be cited as examples. It must also be remembered that the number of known species is very great. The *Flagellata*, forming the second order, are distinguished by the possession of elongated lash-like appendages or *flagella*, although cilia may also be developed. Examples of this group are seen in *Peranema* (with one flagellum), in *Anisomema* (with two), and in *Heteromastix* and *Pleuronema* (with both flagella and cilia). The last order, or *Suctorioria*, is distinguished by its members possessing radiating tubes provided at their free ends with suctorial discs, and which can be retracted or protruded. The exact nature of these suctorial forms (of which *Acineta* is the type) has not been, as yet, thoroughly determined. Some observers think the Suctorial Infusorians simply represent transitional stages in the development of other members of the class—such as *Vorticelle*.

Noctiluca miliaris (fig. 21) is probably an Infusorian allied to the Flagellata. It is the cause of the diffuse luminosity or phosphorescence of the sea, and is noticed in the articles NOCTILUCA and PHOSPHORESCENCE.

The nature of the origin and development of Infusoria have long formed subjects of extreme interest to the biologist. As explained in the article GENERATION (SPONTANEOUS) some authorities or *Abiogenesisists* believe that these forms may be spontaneously produced from the particles or matter of the organic infusions in which they are found; or, in other words, without the pre-existence of parent organisms, of germs, or of eggs. This belief constitutes the doctrine of *spontaneous generation*; and recent supporters of this theory would seem to maintain that these organisms may appear even in infusions of *inorganic* matter, which have not in any way been exposed to the air. The Biogenesisists or Panspermatisists, on the contrary, believe that these Infusoria appear in infusions of any kind as the result of the development of their germs or eggs which are borne by the atmosphere in large quantities, gain access to infusions, and therein become developed into adult animalcules. They also maintain that in cases where air is perfectly excluded, these germs may originally have been contained in the infusion, and that heat does not destroy the germs, these being of a low degree of vitality. The question presents very many difficult points, but probably few scientific men now believe in spontaneous generation. This much is certain, however, that whether or not 'spontaneous generation' be actually proved to occur, there can be no doubt that in ordinary cases these animalcules are produced from germs borne in the air, since the existence of these germs has been duly established, and their development into Infusoria fairly traced.

The *paleontology* of the Protozoa forms a very interesting subject. Only the Foraminifera, Radiolaria, and Spongida are represented as fossils, these groups alone possessing hard structures capable of preservation. The Foraminifera occur in all the fossiliferous rocks from the Laurentian formations to the present day. Of fossil Foraminifera the most famous is the *Eozoon Canadense*, or 'Dawn of Life Animalcule,' which appears to have been a gigantic Foraminifer, occurring in reef-like masses in the Laurentian rocks of Canada. The Nummulites (which see) were also large extinct Foraminifera of the Cretaceous period. The genus *Miliola* is also plentifully represented in a fossil state in the Eocene limestones of the Paris basin. The Lower Silurian formations of Russia contain species of the genera *Rotalia* and *Textularia* (see fig. 24). *Fusulina* occurs in the car-

boniferous limestones of the Southern Alps, Russia, the United States, &c. The chalk or cretaceous rocks of the Mesozoic period, and particularly the white chalk, well seen in the south-east of England, is largely composed of Foraminiferous remains. The Globigerina (fig. 23) of the existing sea-beds, *Rotalia*, and *Textularia* are all represented in the chalk rocks. The upper greensands of the cretaceous system contain the remains of a gigantic Foraminifer, which possessed an arenaceous shell, and which is named *Parkeria*.

The Radiolaria, represented by the Polycystina (which see), occur in Mesozoic, but particularly in Tertiary formations, as in the 'infusorial earth' of Barbadoes. The Spongida are doubtfully represented as fossils by *horny* sponges. The *calcareous* or limy sponges first appear in Silurian rocks, and attain their maximum in the Mesozoic formations, whilst they are few in number in the present day. The *silicious* or flinty sponges first appear in the Mesozoic rocks, and were developed in greatest plenty in the chalk system. These latter exist in comparative plenty in the present day. The Infusoria are not known to occur in a fossil state.

In the accompanying plate, containing illustrations of the sub-kingdom Protozoa as mentioned above, there are also several figures of Cœlenterate animals, belonging to the class Hydrozoa, to which a brief reference may in the present instance be made. Fig. 1 represents a form of oceanic Hydrozoa, *Diphyes* or *Praya*, belonging to the Hydrozoal order, Calycophoridae. In this form we find a couple of large mitre-shaped *nectocalyces* or swimming-bells, and an elongated *cœnosarc* or common connecting medium, bearing the little animals or *polypites*. (See POLYPT.) This *cœnosarc* is highly contractile, through the presence of muscular fibres. Each of the polypites is protected by a delicate glassy membrane known as the *hydrophyllium* or 'bract.' Fig. 2 represents the Physalia or 'Portuguese man-of-war,' described in the article PORTUGUESE MAN-OF-WAR (which see). In figs. 3, 4, and 5 different views of an organism belonging to the order Physophoridae are given. This organism is known as the *Velella*, and is nearly allied to the Physalia. The body consists of a flattened rhomboidal *pneumatophore* or 'float,' bearing on its upper surface an elevated vertical crest, placed diagonally. A single large polypite is situated on this flattened disc, and is nearly central in position, and reproductive bodies termed *gonoblastidia* or *phyogemmæ* are also attached thereto. No *nectocalyces* or swimming-bells exist; and numerous tentacles are attached around the margins of the disc. *Velella* averages about 2 inches in length and 1½ inch in height. It is composed of a transparent substance, coloured blue, and floats on the surface of the sea, being driven along by the wind acting on the vertical crest as on a sail.

Fig. 6 represents *Campanularia* (magnified), one of the Hydroid Zoophytes belonging to the order Campanularida, the members of which group are nearly related to the more familiar Sertularida or 'Sea-firs.' The polypites with their tentacles are seen in the figure, and also one of the *gonophores* or reproductive bodies in its attached condition. Fig. 7 represents the Hydra or common Fresh-water Polype (magnified)—the organism which forms the type of the entire class Hydrozoa. This animal, of minute size, inhabits fresh-water pools and ditches, and consists of a tubular body, attached generally to aquatic plants by one extremity, and possessing a mouth surrounded by tentacles at the other. The protuberances seen on the sides of the figure are the reproductive bodies.

Fig. 8 represents *Bougainvillea*, one of the Gymnophthalmata or Naked-eyed Medusæ (which see) or jelly-fishes. In this genus, belonging to the Hydro-

seal order *Medusidae* or *Discophora*, the *umbrella* or *nectocalyx* is spherical in shape, and the tentacles are arranged in four marginal groups. In fig. 9 *Aurelia*, a common genus of *Medusidae*, is represented, as viewed from below. In fig. 10 *Geryonia*, a genus of *Medusidae*, is depicted; this form possessing a hemispherical umbrella and an elongated peduncle of inversely conical shape, with four lips. An allied form (*Tiaropsis*) is represented in fig. 11. The genus *Sarsia*, of which *S. gemmifera* is a familiar species, is represented in fig. 12. This genus also possesses an umbrella of hemispherical shape, and four marginal tentacles. The ocelli or eyes also number four, and the peduncle is of simple conformation, cylindrical and extensile. In this genus, and as represented in the figure, Medusa-like zooids may be produced by a process of *gemmation* or budding from the marginal canals, tentacles, or sides of the peduncle.

PROTRACTOR. An instrument for laying down and measuring angles on paper with accuracy and despatch, and by which the use of the line of chords is superseded. It is of various forms—semicircular, rectangular, or circular. The most convenient kind of protractor is perhaps that in the form of a circular disk of translucent horn.

PROUDHON, PIERRE JOSEPH, a French publicist, born at Besançon, January 15, 1809; died there January 19, 1865. He was the son of poor parents, who were unable to pay for his education, but by the influence of some persons who had remarked the boy's abilities, he was enabled to attend gratuitously the college of his native town. Before completing his course he was obliged to seek some means of earning his bread, and he entered a printer's office in Besançon, where he ultimately became a compositor. In this quality he made the round of France, and rose to the post of reader. Both as compositor and as reader he took full advantage of the opportunities he had of increasing his knowledge, and supplemented by private studies the fragmentary information that came in his way in the ordinary course of his occupation. In this way he made considerable linguistic acquirements, and his first publication was a philological treatise entitled *Essai de grammaire générale* prefixed to an edition of Bergier's *Éléments primitifs des langues*, which was printed in 1837 by a firm of Besançon, of which Proudhon at that time had some share in the management. In 1838 he had conferred on him by the Academy of Besançon the *pension Suard*, which yielded him an income of 1500 francs for three years, and thus furnished him with the means of continuing his studies and literary labours. In 1839 he published a *Discours sur la célébration du dimanche*, together with a new version of his former essay. Political economy now became his chief study, and in 1840 appeared his famous work, bearing on the title-page the question: *Qu'est-ce que la propriété?* (What is property?), to which the first page of the treatise contains the answer, '*C'est le vol!*' (it is theft). The principal theses there maintained by him are that labour is the sole just ground of individual possession, and that all labour ought to be rewarded equally. This first treatise was followed in 1841 and 1842 by two pamphlets in the same strain. The second of these, entitled *Avertissement aux propriétaires*, was written in a more aggressive and menacing style than any of his previous publications. The public prosecutors at Besançon deemed it necessary to take the matter up, and he was summoned to appear before them and answer to the charges of making an attack upon property, inciting to hatred against the government and several sections of the people, and of committing offences against religion. He has himself given an amusing and dramatic account of the proceedings in

connection with this trial, of the horror which his name and presence inspired among all classes of the people, the surprise excited by his inoffensive appearance and behaviour when he stood up to speak for himself, and the mystification which he caused by his abstruse defence in prosecutors, judges, and the jury, who returned a verdict in this form: '*This man is in a sphere of ideas inaccessible to the vulgar; we cannot condemn him at random; and who will answer for his culpability?*' He was accordingly acquitted. In 1843 Proudhon undertook the management of a system of transports on the Rhône and Saône. But he still continued to publish at intervals. In this very year appeared his treatise *De la création de l'ordre dans l'humanité*, a proposed system of political organization; and in 1846 his *Contradictions économiques*, in which the proposals of Utopian reformers and the doctrines of English political economists are vigorously combated. After the revolution of February, 1848, he began the publication of a journal at Paris called *Le Représentant du peuple*, which, however, was speedily suppressed. But he had by this time acquired so much popularity that he was elected the representative of the Seine in the constituent assembly. In the assembly he had little success, and he therefore showed as much assiduity as ever in trying to make known and extend his ideas through the press. He published several pamphlets (*Le Droit au travail*, *Les Malthusiens*, *Démonstration du socialisme*, *Idées révolutionnaires*), and started three journals in succession, *Le Peuple*, *La Voix du Peuple*, and *Le Peuple de 1850*. In 1849 he began to organize a bank under the name of *Banque du Peuple*, with the object of abolishing interest, securing the free circulation of bills, and consequently putting an end to capital. This project, however, never came to anything, for the projector, before he could get his arrangements completed, was accused of some offence against the press laws, and condemned to three years' imprisonment. He returned the advances that had been made to him on account of the bank, and then sought to save himself by flight, but he was ultimately captured and detained for the term of his sentence. In the first year of his imprisonment (1849) he married, and in spite of his hostility to the church underwent the religious ceremony on the occasion, and afterwards had all his children baptized. During the course of his imprisonment (which was light) he published various works: *Confessions d'un révolutionnaire* (1849); *Actes de la Révolution* (1849); *Intérêt et principal* (1849); *Gratuité du crédit* (1850), the last two a resumé of discussions he had had with Bastiat on the subject of interest, he maintaining that there ought to be no such thing; and *La Révolution sociale démontrée par le coup d'État* (1852). In 1852 he was liberated, and he then entered again into private life. He continued to be a prolific writer, and published during the last years of his life, *Manuel du spéculateur à la Bourse* (1856); *De la justice dans la Révolution et dans l'Église* (1858); *La Guerre et la paix* (1860); *Théorie de l'impôt* (1861); *Les majorats littéraires* (1862). Several works of his have also been published posthumously, among them *Du principe de l'art* (1865); *De la capacité politique des classes ouvrières* (1865); *Théorie de la Propriété* (1865). His Correspondence was published in 14 vols. (1875 onwards).

PROUT, SAMUEL, a distinguished painter in water-colours, was born in Plymouth on 17th September, 1783, and from his earliest childhood manifested a decided turn for drawing, but the only lessons he ever received were a few from a drawing-master in his native town. In 1801 he made the acquaintance of Britton, the celebrated architectural antiquary,

who employed him in visiting the rural districts of England to make sketches, which were engraved in the *Beauties of England*. The favour with which these drawings were received induced him in 1805 to take up his residence in London. In 1818 he visited the Continent for the first time, and frequently again returned thither, the result of these excursions being a vast store of beautiful water-colour drawings, which placed him at the head of this department of art. They consist more especially of the monuments of mediæval architecture throughout France, Germany, and Italy. Prout also directed his attention to lithography, and published several admirable collections of lithographed sketches. He is likewise the author of *Hints on Light and Shadow* and the *Young Student's Drawing Book*, books of instruction in art. Shortly after the ascension of Queen Victoria he was appointed 'painter in water colours to the queen,' and a few years afterwards received a similar appointment from Prince Albert. Throughout life his bodily health was extremely delicate, but he possessed great buoyancy of spirits, and was in every way a most amiable and worthy man. He died at Camberwell in February, 1852.

PROVENÇAL POETS were romantic poets of chivalry in the twelfth and thirteenth centuries in the south of France and in the adjoining parts of Spain. The language known as Provençal was that one of the Romance languages which was earliest formed, and which is least removed from their common parent, the Latin of the vulgar. The domain within which this language was spoken extended over the whole of the south of France, as far as the Loire, and Catalonia and Valencia in Spain. It was called the *langue d'oc* from its affirmative *oc* (derived from the Latin *hoc*), to distinguish it from the language of Northern France or *langue d'oïl*, and it acquired the name of Provençal from the district (Provence) in which it was first cultivated as a literary medium. It was also sometimes called *Limousine*, from the region where it was spoken with the greatest purity. Southern France, already refined by colonies from Greece, and by its vicinity to the Romans, favoured with a milder climate and a freer government, was, until the eleventh century, far in advance of the north in civilization, and its language was distinguished for clearness, tenderness, sweetness, and copiousness. The language, the cultivation acquired by the nobles through their intercourse with the East, particularly with the poetical Arabs, an imagination awakened, and an understanding enlarged by travel and adventure, a romantic spirit, and the wealth produced by commerce—all these circumstances contributed to foster genius and to produce poetry. The poet sang of war and adventures, religion and love, and found encouragement and applause, particularly from the ladies, who were celebrated in his verses. The Virgin Mary was a frequent subject of their praise. The taste for poetry became general among the nobles and cultivated classes in Provence, and the princes, particularly Raymond Berengarius III. (1168-81) and IV. (1209-45), favoured the poetical art. In their court, at that time the most refined and splendid in Europe, it was customary to collect a circle of noble poets, called Troubadours (Italian, *trovatori*), a name corresponding to the Norman-French *Trouvères* or *Trouveurs*. At times the chivalrous festivals of Provence were disturbed by the noise of arms in some private feuds between powerful barons, or were interrupted by the attacks of the Normans or Moors; but the inroads of these plunderers on this coast were neither frequent nor destructive. Sometimes the desire of adventures, or the cry of war in foreign countries, summoned the knights of Provence

to the battles of the other European nations. Thus, for instance, in the wars of King Alfonso VI. of Castile with the Moors, many knights of the south of France fought under the Spanish Cid, and aided in conquering Toledo, by which means they came into close connection with Arabian civilization. The Crusades, to which the first impulse was given in the south of France, at Clermont, in 1095, by Pope Urban VII., and which had so decisive an influence on the whole of Europe, were also felt in Provence. A single war took place upon the happy fields of Provence, which was fatal to the prosperity of that country, and to the poetry of the Troubadours, which never recovered from the effects of it. This was the iniquitous crusade against the Albigenses, in the beginning of the thirteenth century, when the ancient family of the counts of Toulouse was ruined, and the whole land filled with scenes of cruelty and bloodshed.

During this whole period courtesy and gallantry were nowhere so fully developed as in Provence; and we need not be surprised when we see the Emperor Frederick Barbarossa in Germany and King Richard Cœur de Lion in England inviting the Provençal knights to their courts to receive instruction from them in the usages and ceremonies of chivalry. Provence was the native land of the courts of love; and besides the inferior courts of this kind, as numerous as the castles of the viscounts and barons, there were four stationary courts of love at Pierrefeu, at Ramagny, at Aix, and at Avignon. The royal court in Provence, at Arles, was from the times of Boso I. (879), for almost two centuries, the theatre of the finest chivalry, the centre of a romantic life. The assembly of knights and Troubadours, of Jongleurs (musicians who accompanied the Troubadours), with their Moorish story-tellers and buffoons, of ladies acting as judges or parties in matters of courtesy, exhibits a glittering picture of a mirthful, soft, and luxurious life. The knight of Provence devoted himself to the service of his lady-love in true poetic earnest, and made the dance and the sport of the tilt-yard the great business of his life. Each baron, a sovereign in his own territory, invited the neighbouring knights to his castle to take part in tournaments and to contend in song, at a time when the knights of Germany and Northern France were challenging each other to deadly combat. There might be seen the joyous companies of ladies and knights under fragrant olive groves, upon the enamelled meadows, sporting from one holiday to another; there the gallant knight broke his lance on the shield of his manly antagonist; there the princess sat in the circle of ladies, listening seriously to the songs of the knights contending in rhymes respecting the laws of love, and at the close of the contest pronouncing her sentence (*arrêt d'amour*). Thus the life of the Provençals was lyrical in the highest degree; and if it degenerated in later times to voluptuousness and licentiousness this was owing to the want of a strong moral principle. Their poetry was necessarily lyrical, the expression of their feelings and passions. Even deeds and facts were represented merely through the medium and in the form of feelings. Such a poetry could never be more than a continual improvisatory effusion. It was necessarily superficial: it could be of value only with the accompaniment of music, and was not suited to be preserved in writing. With the Troubadour himself his songs lived and died. With regard to rhyme and to the modern metres the Provençals claim not only the merit of having first made use of them, but also of having fixed the form which rhyme and metre assumed in the romantic poetry. In their rhymed metre they have seldom gone beyond the simple

iambic, which they exchanged, mostly in those feet of the verse upon which there is no stress, for the trochee, pyrrhichius, and spondee; so that if their verses (usually of ten syllables) only had the cæsura and the final syllable sufficiently accented, they cared little about the measure of the other syllables. But they were very fond of complicated rhymes. We find in their stanzas not only the same rhyme repeated through a long series of verses, or the same rhymed word returning at the end of every other verse, but variously intertwined rhymes, in *terzinas* and other metres, distinctly point out the pattern of Petrarca's canzone and sonnets. As a specimen of the Provençal Romance idiom, and of their metres, we give the following stanza of a *sirvente* of William de St. Gregory, with its translation, taken from Roscoe's translation of Sismondi:—

Be m' play lo douz temps de pascor
Que fai fuelhas e floras venir;
E play mi quant aux la vaudor
Dels auzels que fan retentir
Lor chan per lo bocatge;
E plai mi quan vey sus els pratz
Tendas e pavallos fermatz;
E plai m'en mon coratge
Quan vey per campanhas rengatz
Cavalliers ab cavals armatz.

The beautiful spring delights me well,
When flowers and leaves are growing;
And it pleases my heart to hear the swell
Of the birds' sweet chorus flowing
In the echoing wood;
And I love to see, all scattered around,
Pavilions and tents on the martial ground;
And my spirit finds it good
To see, on the level plains beyond,
Gay knights and steeds caparisoned.

What we have left of the poetry of the Troubadours are songs of contention (*tensons* or *jocs partitz*), in which some disputed point usually relating to love was discussed in alternate strophes by different minstrels; *satires*; martial and other serious songs on political and religious subjects (*sirventes*—so called as being composed in the service of a master); and numerous small songs (*chanços*), war songs, songs of pastoral life and love (*soulas*, *lais*, *pastourelles*), morning songs and serenades (*aubades* and *serenades*), *retrouvances*, and *redondes*, the latter distinguished by artificial burdens. The poetry of the Troubadours, as in the course of time it became more common, was degraded, not unfrequently, to mere ballad singing, and was exposed to much mockery, of which the nobler singers often bitterly complain. In the nineteenth century such writers as Jasmin and Mistral have endeavoured to resuscitate the Provençal, and have produced in it poems of no small value. The biographies of the Troubadours furnish us with a greater variety of matter than their poetry, which, through all its periods, turns continually upon the same subjects. Some of the most remarkable Troubadours are here mentioned. In the van of the royal and princely singers is William IX., count of Poitou and Duke of Aquitaine, equally famous as a poet and a warrior (born 1071). He was followed by various foreign princes, who gladly saw the exotic plant of gallant poetry transplanted to their courts—the Emperor Frederick Barbarossa, Roger of Naples, Richard Cœur de Lion, with his famous minstrel Blondel, who composed also Provençal verses, and who, according to tradition, discovered the prison of his king by means of his harp; the kings Alfonso and Peter of Arragon, and a vast number of princes and counts in Spain, France, and Italy. The most renowned of the rest of more than 200 Troubadours whose names and poems have been preserved, are Sordello of Mantua, celebrated for his chivalrous exploits and

the praises of Dante; Peire Cardinal, distinguished for his religious and moral *sirventes*, and also author of the only Provençal fable; Guillem Figuietas, composer of a *sirvente* full of fiery declamation against the Roman see; Arnaut Daniel, the most famous of the authors of *tensons*, and the introducer of the measure called the *sextine* (borrowed from the Italian); Pons de Capdoile, Peire Vidal, Gaucelm Faidit, and other authors of crusading songs; Bertrand de Born, who is connected with the romantic adventures of Richard Cœur de Lion; Arnald de Maraviglia, an eminent Troubadour and valiant knight, whose motto was 'A Dieu mon âme, ma vie au roi, mon cœur aux dames, l'honneur pour moi'.—See Sismondi, *Literature of the South of Europe*; Diez, *Die Poesie der Troubadours* (Zwickau, 1827); and *Leben und Werke der Troubadours* (1829); Milá y Fontanals, *De los Trovadores en España* (Barcelona, 1861); J. Rutherford, *The Troubadours: their Loves and their Lyrics* (London, 1873); F. Hueffer, *The Troubadours: a History of Provençal Life and Literature in the Middle Ages* (London, 1878); Restori's *Letteratura Provenzale* (Milan, 1891); Portal's *La Letteratura Provenzale Moderna* (Palermo, 1893); Lantillac's *Les Félibres* (Paris, 1895); &c. Among collections of Provençal literature may be mentioned Raynouard, *Choix des poésies originales des Troubadours* (Paris, six vols. 1816–21); Mahn, *Die Werke der Troubadours* (Berlin, 1846, &c.); and *Gedichte der Troubadours* (Berlin, 1856–73); Bartsch's *Chrestomathie Provenzale* (4th ed., 1880); Appel's *Provenzalische Chrestomathie* (1895).

PROVENCE, one of the old provinces of France, lying in the south-eastern part of the country, on the Mediterranean, bounded on the north by Dauphiné and Vennaisin, on the east by Piedmont, and on the west by Languedoc. The capital was Aix, and the province was divided into Upper and Lower Provence. The départements of Bouches-du-Rhône, Basses-Alpes, and Var, with parts of those of Vaucluse and Alpes-Maritimes, have been formed from it. Greek colonies were founded here at an early period (see MARSEILLES); and the Romans having conquered all the south-east of Gaul (B.C. 124–123) gave it the name of *Provincia Gallia*, or simply *Provincia* (the province), whence its later name was derived. Even after the rest of Gaul had been reduced by Cæsar to the condition of a Roman province, the name of *Provincia* still remained in common use as a designation of that portion of Gaul, which, in the division of that part of the empire made under Augustus, was called *Gallia Narbonensis*. In the first half of the fifth century the Visigoths obtained possession of a large part of Gaul on the west of the Rhone, and the Burgundians of the portion on the east side of the Rhone, from the Lake of Geneva to the Durance. The Roman territory in this quarter, and with it the name of *Provincia*, were thus restricted to the district lying between the Durance, the Alps, and the Mediterranean. About 470 even this remnant was snatched from the Romans by the Visigoths, who remained in possession of it till early in the following century, when they were obliged to resign it to Theodoric, king of the Ostrogoths, in return for the assistance he had rendered them against Clovis, king of the Franks. Less than thirty years after (about 536) the Ostrogoths were in their turn conquered by the Franks, and the *Provincia* or Provence incorporated with the dominions of the latter. In the partitions which took place under the sons of Louis the Debonnaire, Provence fell first to Lothaire, and next to Charles the Bald. On the death of Louis the Stammerer (879) it became a part of the Burgundian

kingdom of Arles. The counts of Arles, however, who held the greater part of Provence, and were hence also called counts of Provence, were only slightly dependent on the Burgundian kings. The male line of the counts of Provence became extinct with Bertrand II. in 1093. For some time after his death (1098-1100) the land was governed by Bertrand's mother, Etienne, and for a few years longer (1100-12) by his sister Gerberge. In 1112 the territory was acquired by Raymond Berengarius, count of Barcelona, by marriage with Douce, daughter of Gerberge. During his reign part of Provence (which now included somewhat more than the district inclosed by the Durance, the Rhone, the sea, and the Alps) was claimed by the Count of Toulouse as the inheritance of his grandmother, daughter of one of the previous counts of Provence; and in 1125 a treaty was concluded between the two counts, according to which the Count of Toulouse received the counties of Voleur, Die, Orange, and Venaisin; and the Count of Barcelona received Provence proper (which then, and till 1365, included Nice) and the county of Forcalquier, that is, the district immediately to the north and west of the Durance. In 1168 Raymond Berengarius II., grandson of the first of that name, died without male issue, and the possession of Provence was contested by the Count of Toulouse and Alfonso II. of Arragon, who belonged to another branch of the counts of Barcelona than that which had hitherto ruled Provence. The King of Arragon was successful, and gave his newly acquired territory to his brother Raymond Berengarius III., who retained it till his death in 1181. Provence then passed to Sancho, another brother of Alfonso, and in 1185 to a son of Alfonso of the same name, who, on his father's death in 1196, assumed the title of Alfonso II. Alfonso II. was succeeded in 1209 by Raymond Berengarius IV., with whom in 1245 the male line of the house of Barcelona, under whose patronage Provençal poetry had attained its greatest perfection, died out. Beatrice, the daughter of Raymond, inherited Provence on her father's death, and on her marriage in the beginning of the following year to Charles of Anjou, brother of the French king Louis IX., and afterwards King of Sicily, the land passed to that house, with which it remained till Joanna I. of Naples in 1382 appointed Louis of Anjou, brother of the French king Charles V., her heir. The counts who followed Louis of Anjou were Louis II. (1384-1417), Louis III. (1417-34), René the Good, duke of Lorraine (1434-80), and Charles III., count of Maine (1480-81). By the last count the territory was bequeathed to Louis XI. of France, by whom it was united to the French crown.

PROVERBS are the flower of popular wit and the treasures of popular wisdom; they give the result of experience in a form made impressive by rhyme, alliteration, parallelism, a pointed turn, or a comparison drawn from the most ordinary scenes and occurrences of life, which, by the force of association, makes their effect strong and permanent. Proverbs may be unassuming, lively, grave, or even sublime; their general character is *naïveté*. The habit of men at the present day to communicate so much with each other by writing, which, exciting the feelings less than conversation, leads to a less animated mode of expression, and the disposition to avoid what is common, springing from the pride of intellectual cultivation incident to an advanced stage of society, and various causes connected with the progress of civilization, make proverbs every day more unfashionable with the most civilized European nations, particularly in this country, where the use of a proverb (except it be one of a foreign nation) is considered almost vulgar; and the same contempt for

these jewels of the multitude has spread to America. Another reason for proverbs going out of fashion may be, that the better a proverb is the more trite it becomes; and what is trite is vulgar, and what is vulgar is inelegant. Thus a public speaker could not use the proverb, 'Twixt crop and lip is many a slip,' at least not without some apology for its triteness, although the very triteness in this, as in most other cases (such as often quoted verses), proves merit; and even this homely proverb undoubtedly has often led to care and thoughtfulness. Proverbs often save long explanations by presenting a striking image; and many a lecture has probably been superseded by the French adage, 'One spoonful of honey attracts more flies than a hundred barrels of vinegar.' So they may be often used with effect to point the conclusion of a discourse. A period on the failure of men who strive beyond their capacity, might be well closed by the Arabian saying which Burckhardt mentions, 'If God purposes the destruction of an ant he gives her wings;' and the vanity of human resolutions could hardly be set in a stronger light than by the Portuguese proverb, 'Hell is paved with good intentions'—a proverb which, until it has become familiar, is awfully impressive. It requires skill to apply proverbs elegantly and judiciously in common life. As to the general worth of proverbs, we would say with one of their number, *Vox populi vox Dei*. Yet there are many directly opposed to others, and they must always be received *cum grano salis*; they are general views of things, and 'no rule without an exception.' Proverbs are plain-spoken. In their view, as in the eye of the law, all are equal. They take cognizance of the virtues, and vices, and follies of all classes, without respect of persons. They pierce the object at which they aim, and this in fact gives them currency, and makes them what they are. Boileau speaks of happy expressions,

'Qui, par le prompt effet d'un sel rejoignant,
Deviennent quelque fois proverbes en naissant.'

Such a phrase is Napoleon's, 'There is but one step from the sublime to the ridiculous,' which may be almost said to have become a proverb, as is the case with many other expressions struck out in happy moments, or proceeding from conspicuous persons. The proverb is nearly related to the motto, symbol, device, sentence, apologue, fable, &c.; and the limit cannot always be easily drawn. Burckhardt gives us the following as Arabic proverbs: The wolf was asked, 'For what art thou following those poor little sheep?' He replied, 'The dust upon which they tread is good for my poor little eyes.' And this one man said to another, 'O slave, I have bought thee.' 'That is thy business,' replied he. 'But wilt thou run away?' 'That is my business,' replied he. These having at once a narrative character, and a concise pointed expression, partake of the nature of the apologue and the proverb. Certain sallies of popular humour, ludicrous personifications, &c., which are frequently repeated, are sometimes called proverbs; as, 'What a dust we kick up, as the fly said to the cart-wheel.' Proverbs being the offspring of popular feeling and experience often serve to keep alive the recollection of peculiar views and customs, and a comparison of the sayings of different nations is very interesting. Probably no language is devoid of proverbial sayings, though no doubt some are richer than others in these modes of expressing 'one man's wit and all men's wisdom.' Among European nations the Spaniards are considered to possess an especially large stock, and the Germans are probably not a whit behind. Many of them are very ancient and crop up in the most distant places, the same in substance though differing in form.

Greek and Latin proverbs were collected by Erasmus in his *Adagia*; English proverbs have been collected by Camden, Howell, Ray, Kelly, Bohn (an enlarged and improved edition of Ray), and Hazlitt; Scotch by Allan Ramsay, and by A. Hislop; French by De Lincy; German by various collectors, more especially Wander (Leipzig, 5 vols.), who illustrates German proverbs by those of other countries; Arabic by Burckhardt and by Freytag; Bengali by Long. Bohn has published a collection of foreign proverbs (translated). See Trench's *Proverbs and their Lessons*.

PROVERBS, one of the canonical books of the Old Testament. It derives its Hebrew name, as usual with the Jewish writers, from its first word *mishlê*, the plural of *mishlâl*, which literally signifies a similitude, but is applied alike to a dark prophetic utterance, a parable, and a proverb. The common title of the book among the ancient Christian fathers was *hê panaretos sophia*, 'the all-virtuous wisdom'. The book is usually in the main ascribed to Solomon, in accordance with the superscriptions in chap. i. 1; x. 1; xxv. 1, which, if not written by Solomon himself (as the first two of them may have been), at least represent the traditional views of the ancient Jewish church. Chap. xxx. and xxxi. are by the same authority ascribed to Agur and King Lemuel, but no information is given relative to the date of these persons, or as to who they were. Such is the traditional Jewish belief, but modern criticism has frequently come to a different conclusion. According to many modern Biblical critics the book of Proverbs should be broken up into several portions, written by different authors and at different times, and finally collected into a single book at some period subsequent to the return from the captivity. All seem to be agreed that some part of the book is to be ascribed to Solomon, but there is great diversity of opinion as to how large his share is. Some attribute to him the greater portion of the proverbs contained in chap. x.-xxii. 16, and a considerable number of those in chap. xxv.-xxix. And of those attributed to Solomon the source is differently given. Some are thought to have been copied from written documents, others from traditions of the wise king's sayings current among the people. Thus chap. i.-ix. are very commonly supposed by the school referred to not to have been written by Solomon. But those who agree in this point differ widely from one another on collateral questions. While Eichhorn and Ewald maintain that it is the composition of a single writer, according to Bertheau several authors had a hand in it. Davidson thinks that in the main it is the product of one mind, but that there are several portions introduced from other sources, as chap. vi. 1-19; ix. 7-10. Hitzig maintains this to be the oldest part of Proverbs, while Davidson sees in it evident marks of a date later than the section extending from chap. x.-xxii. 16, and Ewald places it at a time much later than that ascribed to it by Davidson. With respect to the main collection of proverbs found in chap. x.-xxii. 16, while there is a greater disposition to conform to the ancient tradition of their authorship, there is also a wide departure from it. Davidson, while he attributes the greater number of the sayings to Solomon, refers some of them to oral and others to written sources; and he thinks that the compiler of this collection mixed with Solomon's the proverbs of other peoples, and some also of his own. Hitzig, however, maintains that they bear evidence of having been the composition of a single writer; while Bertholdt argues that they must have proceeded from various sources, and that many of them contain internal evidence that they are not Solomon's. With regard to the other two contributors to Proverbs named in the book itself, Agur and Lemuel, nothing whatever is known;

and in the case of Lemuel it is even suspected that the name is not that of a real personage, but merely a symbolical name for Solomon, for it is thought unlikely that the Jews would expressly borrow any of their proverbs from a foreign source, which must have been the case if the present text is retained, describing Lemuel as a king, and the person so named is taken as a real person different from any of the Jewish kings. The canonicity of the book of Proverbs is represented as a subject of dispute in the Talmud, some having objected to receive the book as canonical on account of the contradictions it contains. It ultimately found its place, however, in all the Jewish lists of the sacred writings, and its claim to a place there is held to be confirmed by the frequency with which it is quoted and referred to in the New Testament. It is assigned by the Jews to the third division of the Old Testament, by them termed Kethubim, or, in the language of Jerome and the early Christians, Hagiographa or Sacred Writings. Among commentaries that of Dr. Horton (1891) in the *Expositor's Bible* may be mentioned.

PROVIDENCE, a city and port of the United States, capital of a county of the same name, in Rhode Island, of which it is the largest place, on two small streams, at the head of Narragansett Bay, 40 miles s.s.w. of Boston, with which and with New York city it is connected by railway. It is one of the capitals of Rhode Island, Newport being the other. It contains a great number of fine buildings, particularly in the eastern division; and owing to the unevenness of the surface it has a picturesque appearance. One of the busiest, and at the same time most attractive parts of the town, is at the common terminus of the railways, where there are some buildings not excelled by any in the United States. The new Union Railway-station itself was completed in 1897. The ecclesiastical edifices are numerous, and some of them handsome, one being a very large Roman Catholic Cathedral. Among other buildings and objects deserving of notice are the new State House, finished in 1898, a large Renaissance edifice built of marble and granite; Providence County Court House; the city hall; Brown University; the Rhode Island School of Design; the Athenæum; the Friends' Yearly Meeting Boarding-school, popularly known as the Quaker College; Dexter Asylum for the poor, a plain and substantial brick building, situated within an inclosure of 40 acres; the Rhode Island hospital; Butler Hospital for the insane, in a park of 140 acres; the Homœopathic Hospital; the First Baptist meeting-house, built in 1775; the State normal school; the Arcade, with its front ornamented with massive granite columns, each of a single block 22 feet high; the Butler Exchange; the state prison; and an elegant theatre. Among the libraries are those of Brown University (80,000 vols.), the Athenæum, and the Public Library (1898), the last occupying a handsome building. Brown University is an institution of some importance. Communication with the various quarters of the city and with the neighbouring towns is kept up by electric and cable cars. Manufactures have made great progress, and the industrial works include flour and saw mills, mills for sawing and polishing marble; cotton and woollen factories, foundries, steam-engine and boiler factories, machine-shops; printing, bleaching, calendering, and dye works, &c. Other articles manufactured are jewelry, furniture, carriages, screws, nails, &c. Providence has a safe and commodious harbour, though it is somewhat difficult of access. Its foreign trade is small, but the coasting trade is important, the city being a great distributing centre. It possesses a number of banks.

Providence was founded by Roger Williams in the year 1636, and incorporated in 1649. During its early existence it suffered much from the ravages of the Indians, in what is called King Philip's war. In 1801 a conflagration laid a large part of it in ashes, and in 1815 a severe gale raised the tide 12 feet above its usual level, by which 300 buildings were thrown down. Pop. (1880), 104,857; (1890), 132,146; (1900), 175,597.

PROVINCE (*provincia*), among the Romans, a district of conquered country, governed by a pro-consul or prætor, and called therefore *provincia consularis* or *prætoria*. But this name was only applied to lands lying beyond the boundaries of Italy. The first Roman province was Sicily, which became one in 241 B.C., after the conclusion of the first Punic war. From the time of Augustus they were divided into the senatorial provinces, and the imperial provinces. The latter comprised those which were most exposed to hostile inroads, and the administration of which was left entirely to the emperor under the pretence of sparing the senate and people the trouble of managing them, but in reality to keep the army in his own hands. Under the empire the provinces were much better governed than they had been under the republic. One reason of this was that the emperors were more disposed to pay regard to the complaints of the provinces than the republican courts had been, for the latter were largely composed of men who had themselves profited, or who hoped to profit, by the same kind of maladministration with which the governors were charged, and were therefore always willing if possible to connive at such offences. In addition to this the provincial governors under the empire received fixed salaries, which lessened the temptation to resort to illegal exactions to indemnify themselves for the expenses that they necessarily incurred in soliciting the office that was an indispensable condition of their governorship. The edict of Caracalla in A.D. 215, which extended the privileges of Roman citizenship to all free subjects of the Empire, did much to lessen the distinction in point of law between Italy and the provinces, and before long Italy was itself divided into provinces. Important changes were made in the administration of the provinces by Diocletian and Constantine at the end of the third and beginning of the fourth century. The former divided the empire into twelve *diocæsæ*, each comprising several provinces and subject to an officer called Vicarius; and the latter separated the civil from the military authority in the provinces. Justinian, however, undid Constantine's change in at least some of the provinces. See PROCONSUL and PRÆTOR.

In modern times the term has been applied to colonies or to dependent countries at a distance from the metropolis, or to the different divisions of a kingdom itself. Thus, the Low Countries belonging to Austria and Spain were styled *provinces*. The different governments into which France was divided previous to the revolution were also called provinces. The name has sometimes been retained by independent states. Thus, the Republic of Holland, after it had thrown off the Spanish yoke, was called the United Provinces; and the Argentine Republic used to be called the United Provinces of La Plata. In the canon law the term is applied to the jurisdiction of an archbishop. In the Roman Catholic Church it is also given to the territorial divisions of an ecclesiastical order such as the Franciscans, as well as to those of the Propaganda.

PROVINS, a town in France, in the department of Seine-et-Marne, 30 miles east of Melun. It has remains of old walls flanked with towers, and is gener-

ally well built. The principal edifices are a large tower, commonly called Caesar's Tower, a keep of the twelfth century; and several churches, including the church of St. Quiriace, a large and ancient structure with a modern dome. Provins is an ancient town, being mentioned in a capitulary of Charlemagne in 802. In the middle ages it was a flourishing place with some 60,000 or 80,000 inhabitants. The roses called *Provins* (or *Provence*) roses have been cultivated from time immemorial within the district. Pop. (1896), 7597.

PROVOST (from L. *præpositus*), in the Scottish burghs, the chief magistrate, corresponding to the English mayor. The provosts of Edinburgh, Glasgow, Aberdeen, Perth, and Dundee have the higher title of lord-provost; while the provost of Edinburgh is further called the right honourable, and the provost of Glasgow the honourable. The heads of several of the colleges in the Universities of Oxford and Cambridge are also styled provosts. In ecclesiastical law a provost is the chief dignitary of a cathedral or collegiate church.

PROVOST-MARSHAL, in the army, is an officer who takes cognizance of offences against discipline, orders the arrest and the punishment of deserters and other offenders according to the sentence of a court-martial, and maintains order generally. He is only appointed with troops serving abroad.

PRUDENTIUS, AURELIUS CLEMENS, one of the early Christian Latin poets, born at Calagurris in Spain in 348 A.D., died after the beginning of the fifth century, practised first as an advocate, and afterwards rose to be a governor. In his latter years he composed a great number of songs or hymns, partly for family use, and partly in praise of the martyrs, or on similar subjects of a religious nature. His verses display the characteristics of the time, but contain many beautiful thoughts. See Thackeray's *Translations from Prudentius* (1890).

PRUD'HOMMES, CONSEILS DE, courts of conciliation in France for deciding small disputes between workmen and employers. The first councils called by this name in Paris were formed in 1296 in the reign of Philippe le Bel, when twenty-four *prud'hommes* were appointed to assist the provost of the merchants in settling disputes between the merchants and manufacturers who attended the fairs and markets of the town. In 1464 Louis XI. permitted the burghers of Lyons to choose a *prud'homme*, whose functions were similar to those of Paris. A still more ancient institution of the same kind existed in Marseilles and other maritime towns for enforcing the fishing regulations of the port and settling disputes among the fishers. At a later period a tribunal of this kind existed at Lyons for judging the disputes between the silk manufacturers and their workmen. It was suspended by the laws which swept away all private privileges at the revolution; but inconveniences having been occasioned by its abolition, it was reconstituted in 1803. Similar tribunals were established in other towns, and laws passed at various times to regulate them. After the revolution of 1848, at which period seventy-five towns had *conseils de prud'hommes*, the whole legislation on this subject was revised. By the law passed 27th May, 1848, all the patrons and workers of industrial establishments within the circle of jurisdiction of the council of *prud'hommes* were made eligible as electors, a patron and a working-man presiding alternately for three months in the electoral colleges. The diets of conciliation must consist of two members, one a patron and one a worker; and four of each class constitute the general council. In June, 1853, a law was passed, which, with some modifications, is still in force. The patrons and the workmen are formed

into separate electoral colleges, the latter including managers and foremen, each to elect an equal number of prud'hommes. Half the number are re-elected every three years, the retiring members being re-eligible. The electors are convoked by the préfet. The general council, besides the president and vice-president, is composed of an equal number of patrons and workers. The judgments of the council must be signed by the president and secretary. The jurisdiction of the councils is summary and without appeal for sums under 200 francs; above that sum an appeal lies to the tribunals of commerce. When a judgment is given for more than 200 francs, immediate execution without security may be ordered up to that amount. A supplementary law of 24th May, 1864, on the discipline of conseils de prud'hommes, provides for the performance by the members of these councils of their duties. The presidents and vice-presidents of the conseils de prud'hommes are appointed by the executive power, and need not belong to either of the classes from which the other members are chosen. The number of conseils de prud'hommes is now about 140.

PRUNES, the dried fruits of certain kinds of plum-trees. See **PLUM**.

PRUNING is the severing of portions of the stem, branches, shoots, leaves, or roots of a plant for the purpose of removing excrecent or unprofitable growths, and rendering the sap more conducive to the nutrition of the valuable parts. Pruning is especially necessary to trees which are subjected to artificial treatment. For example, in a tree growing as a standard the branches are free to point in all directions, but when trained against a wall they are limited to a flat surface, on which the whole natural growth cannot be disposed without crowding. Although, if the soil is good, the root might sufficiently nourish the whole growth, the leaves and shoots could not be duly exposed to the light. The immediate effect of pruning is to reduce the growth of a plant in as far as it depends on the amount of foliage duly exposed to the light, but as by judicious pruning the parts left have not only a greater share of sap, but are better exposed to the light, its ultimate effect is to produce a larger and stronger plant.

The tendency of sap to flow in increased quantity into the parts immediately adjoining those where its flow has been interrupted gives an almost unlimited power to the gardener of controlling the direction of the growth of a plant. For example, in fig. 1 there are two shoots, *a* and *b*, and it is desired to have two others at the heights *c* and *d*. To ensure this the upright leading shoot is pruned off in winter at *e*. The upward flow of the sap thus

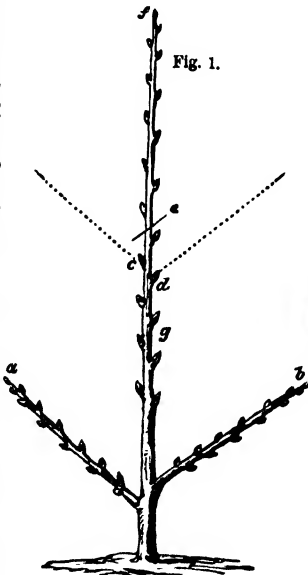
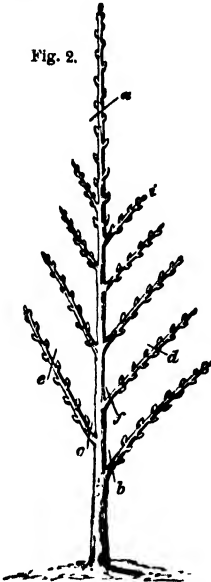


Fig. 1.

diverted will be exerted on the immediately adjoining parts, and the three buds immediately below the section will almost certainly push into shoots, the uppermost supplying the upright leader, the other two the side shoots, which will tend in the direction of the dotted lines. By cutting at *g* the three lowest buds on the upright stem might have been developed in like manner.

To train plants by pruning, however, requires experience and judgment. Suppose it is wanted to

Fig. 2.



form a head at *a*, fig. 2, with a clean stem from the ground up to it, how should we proceed? The most obvious way might seem to be, after pruning at *a*, to cut off at once all the branches from *b* to *i*, and this has often been done in such cases. But this is overlooking the fact that the parts above-ground have an important function to perform in the nourishment of the plant. The ascending sap from the root is only fit for nourishing the plant when it has undergone the organic changes due to the action of air and light exerted upon it in its passage through the vascular system of the leaves, and the roots themselves are nourished, like other parts of the plant, by the returning flow of sap thus prepared. On the branches between *b* and *i* there would be a greater aggregate

breadth of foliage than between *i* and *a*. If on all the shoots between *b* and *a* there should be 125 leaves, and only twenty-five between *i* and *a*, by cutting off all the shoots between *b* and *i* the entire plant would be deprived of four-fifths of its means of growth. So severe a privation would seriously check the development of the roots; and though the buds below *a* might freely appropriate all the sap diverted by the excision, it would be very limited in amount. But if the plant is in a healthy growing state it may be deprived of a moderate portion of its foliage without injury; and when the deficiency has been made good by a new expansion of foliage on the remaining parts, another portion may be cut off, and so on. Thus, in fig. 2 we may cut off the lower branch close to the stem at *b*, and the two next shoots may have their points pinched off at *c* and *d*. This will divert part of the flow of sap from these shoots into the upright stem and the remaining laterals, so that their foliage will expand more rapidly. The two shoots stopped at *e* and *d* may then be cut off at *e* and *f*. This will probably be enough for one season, with the exception of pinching the tops of one or two more if they appear to grow too vigorously. In the autumn, when the wounds already made have been healed by a new growth of albumen, or in early winter, the remaining shoots may be cut off, after which the buds above *i* will in due course swell boldly and push vigorous shoots. For a similar reason the upright stem above *a* may be allowed to remain during the first pruning operations, and be cut off in autumn when the foliage between *i* and *a* has become developed. In like manner a single stem for growing wood may be developed by judicious pruning, while the natural growth would have dis-

tributed the wood in a variety of comparatively useless branches. Bent or kneed timber can also be produced with the aid of pruning in a variety of ways, as by bending the central shoot when young, or by diverting the principal growth into a naturally divergent limb.

The proper time for pruning varies according to the nature of the plant and the object to be promoted. Deciduous trees should not generally be pruned in spring, as the active circulation of the sap will cause them to be impoverished and often to die from bleeding. A little pruning may be performed in summer, for the purpose of securing a larger exposure to light; but autumn or winter is generally the best season for extensive pruning. Pruning in spring not only weakens the plant, but is liable to alter the quality of the sap and induce disease. This probably arises from the sap flowing from the root in greater quantity than can be converted for the purposes of nutrition. Pruning in autumn produces vigorous shoots, and the excess of vigour sometimes requires to be abated. For this purpose summer pruning is best adapted. When a plant is cut in autumn to a given form, the upright shoots will naturally outgrow the others, and alter the form in summer. Summer pruning is best adapted to check this overgrowth, as it is less liable than autumn pruning to increase the flow of sap to the immediate vicinity of the point of excision. If in summer the parts are reduced to an equal quantity of efficient foliage, their growth will probably continue equal.

Root-pruning consists in shortening the roots of a plant. Its immediate effect is to reduce the supply of nourishment, and by checking the rapidity of growth, it has within certain limits a tendency to promote the development of blossom-buds. When roots are injured by transplantation, it is generally better to cut the bruised or lacerated parts clean off, as the young roots are thereby encouraged to push from the sound portion. When root-pruning is used to check excessive vigour it must not be done to a greater extent than will just suffice for the immediate

purpose. As in the case of branches, it is better that extensive pruning should be effected by stages. The best time for root-pruning for fruit-trees is immediately after the leaves have fallen in autumn, or before the sap has begun to flow actively in spring. Taking up fruit-trees every second year and replanting them is now recommended by good authorities as preferable to root-pruning.

PRURIGO, a disagreeable and severe itching affecting the skin, belonging to the class of diseases called papular, consisting of the elevation of minute papule or points upon the surface. It occurs most frequently in spring or summer, and is commonly connected with derangement of the digestive organs. The treatment consists in clearing the bowels by a cooling aperient and the use of the warm bath, or in obstinate cases of the sulphuretted bath. A variety called *prurigo senilis* is sometimes connected with chronic disease of the viscera. This form of the disease alone is dangerous, and may be incurable.

PRUSSIA (German, *Preussen*; French, *Prusse*), KINGDOM OF, the leading state of the German Empire, comprising the greater part of North Germany, forms a tolerably compact territory extending from lat. 49° 8' to 55° 35' N. and lon. 5° 50' to 22° 15' E. It is bounded south by France, Bavaria, Saxony, Bohemia, and Austrian Silesia; west by France, the Netherlands, and Belgium; north by Denmark and the Baltic; north-east and east by Russia. The length of Prussia is 700 miles from east to west, and breadth 470 miles north to south. After the war of 1866 Prussia annexed the Kingdom of Hanover, Electoral Hesse-Duchy of Nassau, free city of Frankfurt, Duchy of Schleswig-Holstein, portions of Bavaria (Caulsdorf, Gersfeld, and Orb), and portions of the Grand-duchy of Hesse (Landgraviate of Hesse Homburg, Amt Homburg, and Amt Misenheim); thus receiving an accession of 27,810 square miles of area and 4,285,700 of population. The names, areas, and population (according to the census of 1900) of the provinces into which the kingdom is divided are given in the following table:—

Area and Population according to the census of 1900 of the Provinces of Prussia, with the names of the Governments contained in each

Provinces	Governments	Area, square miles	Population, 1900.
East Prussia	Königsberg, Gumbinnen	14,777	1,094,417
West Prussia	Danzig, Marienwerder	9,846	1,593,459
Brandenburg	Berlin (City), Potsdam, Frankfurt	15,404	4,092,102
Pomerania	Stettin, Köslin, Stralsund	11,629	1,634,650
Posen	Posen, Bromberg	11,180	1,888,055
Silesia	Breslau, Liegnitz, Oppeln	15,556	4,668,378
Saxony	Magdeburg, Merseburg, Erfurt	9,746	2,833,224
Schleswig-Holstein	Schleswig	7,219	1,387,667
Hanover	Hanover, Hildesheim, Lüneburg, Stade, Osnabrück, Aurich	14,856	2,690,336
Westphalia	Münster, Minden, Arnsberg	7,800	3,188,072
Hesse-Nassau	Kassel, Wiesbaden	6,138	1,897,310
Rhineland	Koblenz, Düsseldorf, Köln, Trier, Aachen	10,414	5,758,995
Hohenzollern		441	66,783
Total (1900)		134,506	34,463,877
Population in 1895			31,555,123
Increase			2,608,254

The small island of Heligoland (in German, *Helgoland*), transferred by Britain to Germany in 1890, belongs to the government of Schleswig. The average density of the population in Prussia is about 256 to the English square mile. The Rhine Province (Rhineland) is far the most densely peopled, while Pomerania and East Prussia have the smallest population per square mile. Almost every province showed an increase in 1900 over the population of 1895, the only exception being East Prussia. The urban population in 1895 was 12,954,591, showing an increase since 1890 at the rate of 1·84 per cent per annum. The increase in the rural population was only ·89 per cent per annum. Berlin is the

capital and the largest city, others being Breslau, Cologne, Frankfurt, Hanover, Magdeburg, and Düsseldorf.

Prussia is naturally divided into two great sections, the one of which, by much the larger of the two, belongs to the great European plain, and may be called the Prussian plain, while the other in the south-west belongs to the German plateau, and may be called the Prussian table-land. It will be well to treat them separately in describing their geographical features.

PRUSSIAN PLAIN.—The whole of northern and eastern Prussia, from Holland on the west to Russia on the east, may be described generally as a vast plain.

considerably elevated in the south and south-west, and thence descending at first rapidly, and afterwards very gradually, towards the Baltic and the German Ocean. The loftiest summits are on the southern frontiers of Silesia, where the Riesengebirge and the Sudetes form the boundary between it and Bohemia and Moravia, and send northwards several ramifications which, without attaining a very lofty height, form wild and romantic scenery, averaging about 2220 feet in height, but lowering northwards to an average of 900 feet; after which the surface loses its hilly character, and forms extensive plains. The highest mountain is Schneekuppe, in the Riesengebirge (5257 ft.). In the south-west ramifications of the Thuringian forest and of the Harz appear, and cover a considerable portion of the southern part of the province of Saxony, but here the average height does not exceed 1000 feet, and soon diminishes to less than 500 feet. The large space extending between the northern foot of these mountain districts and the shores of the Baltic does not present the appearance of a monotonous flat, but though generally low and tame, heathy and swampy, is often finely diversified, and even rich in scenes of rural beauty. Ultimately, however, in approaching the shores of the Baltic and North Sea, the general level becomes so low that large tracts are saved from inundation only by low sand-hills or banks of gravel which the waves have thrown up. Behind these hills and banks extensive lagoons, on the Baltic coast called Haffs, have been formed, communicating with the sea by narrow outlets, and giving to the shore one of its characteristic features. The whole coast is flat and uninteresting. Very few undulations occur to break its monotony; no bold cliffs appear, and the water shallows so much that good harbours are extremely rare. The only large gulf is that of Danzig, within which the town of the same name possesses by far the most frequented port. On the Baltic coast are the islands of Wollin, Usedom, Rügen, Fehmern, Alsen, &c., and in the North Sea are the North Frisian Islands and the East Frisian Islands.

Rivers and Lakes.—The whole of this portion of the Prussian monarchy belongs to the basins of the Baltic Sea and the North Sea. The principal river which drains it is the Elbe, which, entering from the north of Saxony, traverses it by a series of remarkable bends, mainly in a N.W. direction, and finally, after passing through Hanover, enters the North Sea between that province and Holstein. The chief affluents which join the Elbe between Saxony and Hanover are the Black Elster, the Mulde, the Saale (which receives the White Elster), and the Havel. The Weser, with its tributary the Aller, and the Ems, are the principal rivers west of the Elbe. The share of drainage received by the Baltic is conveyed to it by a number of large and independent streams. Of these, commencing with the eastern boundary of the basin of the Elbe, the most important is the Oder, the only large river which can be considered wholly Prussian, since its course, with exception of its commencement as a mere mountain torrent, lies wholly within its territory, which it traverses circuitously S.E. to N.W., receiving the Malapane, Bartsch, and above all the Warta, augmented by the Netze; and the Neisse of Silesia, the Bober, and the Neisse of Górlitz, and entering the Baltic by the Pommerische Haff. Next in importance to the Oder, and communicating with it by a canal between the Braa and the Netze, is the Vistula or Weichsel, of whose course only the lower part belongs to Prussia, which it enters from Russian Poland, flows in a northern direction without receiving any large affluent, and throws off two large branches which enter the Frische Haff, while the main stream

continues its course past Danzig to the gulf of that name. Between the Oder and Vistula a number of small streams, among which the Rega, Persante, Wipper, Stolpe, Lupow, and Leba may be mentioned, carry their waters directly to the sea, and thus form small independent basins. To the east of the Vistula the first river of importance is the Passarge, and after it, still further east, the Pregel, with its tributary Alle. The last river on the east is the Niemen or Memel, which has only a small part of its lower course in Prussia, but penetrating far into Russia, forms one of its important navigable outlets. Lakes abound in almost every province, but more especially in those of Prussia proper, including East and West Prussia, and of Pomerania and Brandenburg. The large lagoons such as the Pommerische Haff, Frische Haff, and Curische Haff, with many others of a similar description lining the coast, have been already referred to. The inland lakes are far too numerous to admit of specification. In East Prussia alone 115 have been counted, though their extent individually is so small that the whole area occupied by them is not more than 320 square miles. West Prussia counts 58 inland lakes, Pomerania 66, Brandenburg 131; there are also many in Posen and in Schleswig-Holstein. Many of these lakes are well supplied with fish, but generally possess few attractions, either in themselves or in the scenery around them.

Geology.—Tertiary strata prevail over almost the whole of the level portion of Prussia. In the mountainous districts of the eastern part of the monarchy the loftier summits are composed of granite, gneiss, mica schist, porphyry, diorite, &c. These are most largely developed in the mountains of Silesia, and even in some of its flatter parts, and are also seen in the circle of Schleusingen, in the Saxon government of Erfurt, in the Brocken, forming part of the Harz, and in isolated spots in the vicinity of the town of Halle. Metamorphic rocks, clay-slate, and limestone extend along the frontiers of Austrian Silesia into the Upper Silesia of Prussia as far as the Oder, and also north of the Riesengebirge, in the districts of Schweidnitz and Waldenburg, and west to the Queiss. Rocks of the same formation occupy a considerable part of the flatter districts of Prussian Saxony, more especially in the vicinity of Magdeburg, and along the banks of the Ohre. Secondary formations, composed of mountain limestone and the various strata of the carboniferous system, occur in Silesia, chiefly in two localities in Upper Silesia along the frontiers of Cracow and Russian Poland, and among the mountains in the county of Glatz, and towards the Riesengebirge. Rocks still higher in the series, and including the new red sandstone and others, enter Prussian Silesia from Poland on the east, and extend west to the Oder near Krappitz, and to a considerable distance inland. They also occupy an extensive tract in the province of Saxony, covering part of the terraces of the Thuringian forest, and stretching along the northern and eastern foot of the Harz to the banks of the Saale, Elster, and Elbe. Chalk and its accompanying beds occur in many different localities, more especially on the north side of the Harz, and in Silesia, both in its higher districts and on the frontiers of Poland. Chalk also appears near Inowracław, in the province of Posen, near Templin, and Prenzlau, in the government of Potsdam, near Gutzkow, in the government of Stralsund, and lastly in the island of Rügen, where it forms the romantic cliffs of Stubbenkammer and Arkona.

Climate.—The above described portion of Prussia, extending over 6° of lat. and about 16° of lon., and consisting in one direction of lofty mountains, and in another of low flats stretching along an inland sea, and inclosing between them large tracts of undu-

lating land, must necessarily present considerable diversities of climate. At Erfurt, in lat. $50^{\circ} 59' N.$, and about 900 feet above the sea, the temperature of the year is $52^{\circ} 1'$; of winter 84° and of summer $71^{\circ} 20'$ Fahr. At Berlin, in lat. $52^{\circ} 30' N.$, but at a much lower level, only 130 feet, the annual temperature is the very same, though both the extremes of winter cold and summer heat are somewhat greater. At Stralsund, in lat. $54^{\circ} 19' N.$, but at a level rather under 50 feet, the temperature of the year is $51^{\circ} 48'$; of winter $32^{\circ} 30'$, and of summer $68^{\circ} 30'$ Fahr. The average of a number of places situated between the highest and lowest latitudes gives a mean annual temperature of 52° Fahr. At Berlin from 159 to 160 days of the year are rainy, from 33 to 34 obscured with mist, and 17 stormy. On the coast of the Baltic the stormy days amount to thirty, the greater part of them in summer; and the quantity of rain is also much increased. Least rain falls in Silesia and the eastern provinces. The prevailing winds are west and south-west.

PRUSSIAN TABLE-LAND.—The south-western division of Prussia, consisting of the greater part of Westphalia, the Rhenish province, and Hessen-Nassau, differs so much from the eastern division as, in many respects, to present a striking contrast to it. All the mountainous parts of the former are situated on its southern and western frontiers, and on receding from them long tracts are wandered over in which nothing that can be called a mountain is to be seen. The present division of the monarchy is much more finely diversified. Its mountains, though far less elevated than those on the frontiers of Silesia, are not confined to a particular locality, but stretch across the country in all directions, and form numerous valleys, one of which, that of the Rhine, here occupies no inconsiderable portion of the whole surface, and in point of fertility and beauty is not surpassed by any other valley in Europe. Towards the north of the Rhine valley a mountain range of moderate elevation, forming a continuation of the Wesergebirge, stretches across the governments of Minden and Munster. To the south of it that of the Teutoburger-Wald extends in a north-west direction, and near Bielefeld attains its loftiest height, not exceeding 1030 feet. This is succeeded, to the south, by a low range, known by the name of the Haar or Haarsrang, the highest point of which is scarcely 700 feet. This range, commencing between Brilon and Stadtberg, stretches west across the north of the government of Arnberg, in the direction and along both banks of the Mohne and Ruhr, presenting to both rivers, and on both sides, but particularly on the south, a number of bold and romantic precipices. Still further south the Sauerland or Süderland Mountains appear. Towards the east, where they take the name of the Rothlager or Rothhaar, they attain their highest elevation, which, in the Astenberg, is 2625 feet, and in several other summits exceeds 2000 feet. The last range, on the east or right bank of the Rhine, is the Westerwald, which reaches the height of 2000 feet. A part of this range, forming its western termination, stretches along the banks of the Rhine, and presents the remarkable summits known by the name of the Siebengebirge. On the left bank of the Rhine, and on the southern part of the Rhenish province, the principal mountains are the Eifelgebirge, which have their greatest breadth between Andernach and Bonn, stretch from the Rhine westward for about 45 miles, and, though generally low, attain the height of 1590 feet; and the Hunderück, occupying a large space between the Moselle and the Nahe, and attaining, in the loftiest summits of the Iderwald and Hochwald, the respective heights of 2260 and 1560 feet.

Rivers.—By far the greater part of this portion of the Prussian monarchy belongs to the basin of the Rhine, which, entering it on the south-east, traverses it in a N.W. direction, and enters Holland to the north of Cleves. It thus receives a large part of the drainage of the region directly, and is, moreover, augmented within it by numerous streams, of which the most important are, on the right bank, the Lahn, the Sieg, the Wipper or Wupper, the Ruhr with its tributary Lenne, the Emscher, and the Lippe; and on the left the Nahe, the Moselle with its tributary Saar, and the Erft. In the north-west a considerable space belonging to the basin of the Rhine is drained by the Maas or Meuse, and its tributaries the Roer and Niers. The rest of the drainage, forming a small portion from the north and east, is shared by the Ems and the Weser. There is not a single lake deserving of notice for its magnitude. The most remarkable is Laachersee, about 6 miles from Andernach, occupying, apparently, the crater of an extinct volcano, and, though of small extent, above 214 feet deep.

Geology.—In this part of Prussia there are no primitive rocks of granite, gneiss, and mica-slate. The prevailing rocks, particularly in the south, are volcanic, and consist chiefly of basalt, augite, porphyry, and similar volcanic products of the tertiary period. The secondary formation, and more especially mountain limestone, and the overlying strata of the carboniferous system, are largely developed in the north, in the circle of Tecklenburg, in the government of Münster, at the north-western foot of the Sauerlandgebirge, along the Ruhr, between Arnberg and Dusseldorf in the west, at the northern foot of the Eifel, near Aix-la-Chapelle, and in the south, in the government of Treves, particularly in the neighbourhood of Saarbrück. The New Red Sandstone, with its accompanying rocks and fossils, occupies a considerable part of the higher districts in the government of Minden, and also occurs on parts of the Eifel, and along the Moselle and Saar, in the government of Treves. Lias and Oolite are found in the north among the hills which lie between the Weser and the frontiers of Hanover. The chalk formation has its largest development in Westphalia, more especially on the western side of the Teutoburger-Wald, in the Sauerlandgebirge, between the Ruhr and the Lippe, and more partially in the government of Münster.

Climate.—Within the same ranges of latitude, and at nearly equal heights above the sea-level, the climate of the western is superior to that of the eastern division of the monarchy. The mean annual temperature is about 1° higher, the winter is milder, and the summer cooler, and the range of the thermometer is accordingly confined within narrower limits. The fall of rain, however, is greater, averaging 20 inches in the west and only 15 inches in Silesia and the eastern provinces. This, however, cannot be considered a disadvantage, as the larger quantity of the western is by no means in excess, and only tends to make vegetation more luxuriant.

The principal physical features of the two great divisions of the monarchy have now been considered separately, but it will not be advisable to follow the same course in considering its industrial resources, both because the most important statistics relating to these are often so lumped together that it is scarcely possible to separate them, and the same branches of industry are common to both divisions.

Agriculture.—The land in Prussia is much subdivided, especially in the more populous districts, small farms of 3 or 4 acres being the most common holding. The total number of farms in 1895 amounted to 3,308,126, of which only 20,390 exceeded 100 hectares (247 acres) in area, whilst one-half were under one hectare (2.47 acres). The whole monarchy is

situated between the parallels of latitude under which all the ordinary cereals are easily matured, and there is nothing in the elevation of the surface, except in a few particular localities, to unfit it for general cultivation. In the more southern portions, even though only to a limited extent, the vine thrives well, and yields some wines of good repute. The arable and garden land is about 50 per cent of the whole, meadows and pastures 15 per cent, woods 23·5 per cent, unproductive territory, 10·2 per cent. The soil includes all varieties, from light sands, almost carried by the wind, to the most obdurate clays, but has been subdivided into the three classes of wheat land, light loams of middling quality, and sandy or stony land. The wheat land, which is in most cases remarkably productive, is found chiefly in the Prussian provinces near the frontiers of Poland, and along the banks of the Memel and Pregel, till the coast is approached, when the sandy soil begins to prevail, in the province of Posen, in the government of Breslau, on the east bank of the Oder, and generally throughout Silesia, between the Oder and the mountains. In Brandenburg the wheat land occurs only in isolated spots, with the exception of a rich continuous tract which extends along the Oder from Frankfurt into the north of the government of Potsdam. The same tract, spreading out into a broad zone, occupies a large portion of Pomerania, both extending north to the extremity of the Isle of Rugen and west to the Prussian frontier. In the province of Saxony the wheat land occurs chiefly in the southern part of the government of Magdeburg, where a plain, known by the name of the Magdeburger Borde, is considered the richest and best cultivated in the monarchy, and also occupies a considerable part of the government of Erfurt. In Westphalia it forms the southern part of the government of Minden, where the Warburger Borde is celebrated, and extends through part of the government of Arnberg, particularly in the vicinities of Soest and Hellweg. Still more productive tracts are found in the northern half of the Rhenish province, between Aix-la-Chapelle and Bonn, as far as the frontiers of the Netherlands, and in the southern districts of the government of Treves, along the banks of the Saar. The loams of middling quality prevail in the government of Bromberg, the northern part of Silesia, generally throughout the province of Brandenburg, in the eastern half of the government of Merseburg, the north of Magdeburg, the eastern part of Minden, the whole of the government of Münster, and lastly, in the government of Coblenz. The sandy and stony land of barren quality is found in large continuous flats in the governments of Gumbinnen and Königsberg, where, for the most part, it forms the northern boundary of the heavy wheat land. It prevails in the governments of Danzig and Marienwerder, generally along the shores of the Baltic, along the frontiers of Silesia, particularly in the southern and eastern districts. In the interior of the province of Brandenburg, too, though the very heart of the monarchy and in the environs of the capital, the soil belongs decidedly to this class, consisting of immense tracts of sand which spread out like a sea, while occasional patches of middling or even fertile wheat land rise up and appear like islands in the midst of it. Nor are similar tracts unknown in the western division of the monarchy. Besides small stretches in the government of Minden, and a large tract in the west of Münster, the sandy and stony ground forms the larger part of the government of Arnberg, which lies along the Sauerlandgebirge, whence the very name of Sauerland has been derived from the sterile and sourish nature of the soil. Similar ground occurs in the governments of Cologne and Coblenz, and on the plateaux which reach to the Westerwald. The

different soils above described, and the extent of the districts over which they spread, furnish us with an easy means of ascertaining the nature of its different products. On the first soil, as its name indicates, wheat is the prevailing crop, and alternates chiefly with hay and beans. Like the rest of Germany, Prussia now imports a considerable quantity of wheat and other cereals. Rye and oats are both much more extensively grown and used than wheat, but barley is of smaller importance, alike in the area occupied and the annual produce. Another very important crop, the culture of which is more or less extensive in every district, is that of potatoes. Of these a great proportion are consumed by the distilleries alone in the manufacture of a rather coarse kind of spirit. Beet-root for the production of sugar has for years been a very important crop. Hemp and flax are also extensively cultivated, more especially the former, which furnishes large supplies for the home manufactures, though much has to be imported. Much tobacco is also raised. Oil plants are important objects of culture, particularly linseed, which forms an important article of export from Eastern Prussia, while large exports of clover and other seeds take place from Brandenburg and the Rhenish province. To the latter province the culture of the vine is chiefly confined. The largest space occupied by vineyards is in the governments of Coblenz and Treves. The culture, on a smaller scale, is carried on in the governments of Cologne and Aix-la-Chapelle, and also in Saxony, Brandenburg, Posen, and Silesia. The system of agriculture generally pursued, though much improved in recent times, is still very defective. The same remark applies to the breeds of domestic animals, in which great improvement still requires to be made, though much has been done by the government, more especially in the case of horses, by the establishment of breeding studs in different localities, and on a general system. The fisheries form an important source of revenue. The best afforested governments are Frankfurt, Potsdam, Iegnitz, Marienwerder, Cassel, Königsberg, Oppeln, and Posen. Sylvicultural knowledge and practice have made great strides in recent times.

Minerals.—Prussia has a great variety and abundance of mineral wealth. Of nearly 110,000,000 tons of coal raised in Germany in 1900 Prussia produced almost 102,000,000, and she contributed 34 million tons of lignite to the total amount of 40 million tons for the empire. Her production of iron ore for that year (4½ million tons) was nearly a quarter of the total for all Germany, and her output of pig-iron (5½ million tons) was more than two-thirds of the production of the whole empire. About a half of the zinc production of the world comes from Prussia, her total for 1900 being 155,760 tons, and most German lead and copper are of Prussian origin. The total value of the mining products of the kingdom in 1900 was £54,800,000, the total for the empire being £63,000,000. The output of Prussian foundries in the same year was valued at about £29,200,000, out of a total for all Germany of about £35,000,000.

The output of coal is now more than six times what it was in 1848, and that of lignite is more than four times its amount in the middle of last century. The five great coal-producing regions of the Prussian monarchy are: the Rhenish-Westphalian basin, in the lower valley of the Ruhr, west of Dortmund; the Saar basin, in the neighbourhood of Treves, extending into Lorraine; the Aachen-Eschweiler basin, an eastward continuation of the Belgian coal-fields; the Upper Silesian basin, in the Beuthen-Ratibor district, extending into Poland and Austria

Silesia; and the Lower Silesian basin, in the Waldburg-Neurode district. Coal is also worked in the Osnabrück region and the Deister valley in Hanover, at Ibbenbüren in Westphalia, and to a less extent in other districts. Lignite is widely distributed, especially in the provinces of Saxony and Brandenburg, in Lower Silesia, and in the governments of Cologne and Cassel. The precious metals are of small importance in the mineral output of Prussia, but some silver is obtained at Klausthal, in the Harz mountains, in the Rhine province, at Tarnowitz in Upper Silesia, and elsewhere. Iron is obtained in considerable quantities in the governments of Coblenz, Arnsberg, and Wiesbaden in the west, of Hildesheim and Osnabrück in Hanover, and of Oppeln in Silesia. It is smelted from its ores chiefly in the great manufacturing districts of the Rhine province and Westphalia, and in the great industrial region in Upper Silesia. Lead is found mostly in the Rhine province, Upper Silesia, Hanover, and the government of Wiesbaden, and copper occurs mainly in the neighbourhood of Halle. Upper Silesia, especially Tarnowitz, is the chief source of the supply of zinc, but the Rhenish-Westphalian region also yields some. Cobalt, nickel, and other metals are found and worked in smaller quantities, and pyrites is obtained from Westphalia.

After the metals the most valuable mineral productions of Prussia are probably rock-salt and salts of potassium, magnesium, &c. The Staßfurt beds in the province of Saxony are of the utmost importance in the potash and magnesium industries, and rock-salt is found not only in many parts of the same province, but also in Posen, Brandenburg, Hohenzollern, &c. Silesia and Westphalia yield marble, and in Upper Silesia a considerable quantity of lime is produced. Porcelain is found at Wettin in the province of Saxony, and other kinds of clay are abundant. Saxony is the chief source of the gypsum supply. In the Weissenfels-Zeitz district of the same province mineral oils and paraffin are now extensively produced. The amber of the Baltic coast is also of some importance. Building stone is plentiful throughout the kingdom, and the numerous moorland stretches yield abundance of peat. The governments of Wiesbaden and Cassel, and the provinces of the Rhine and Silesia, contain many highly esteemed mineral springs.

Manufactures.—These have made great progress, and are not confined to any particular districts, but generally diffused over all the provinces. Certain localities, however, form distinctive manufacturing centres, such as the large towns, the valleys of the Rhine basin, the districts of Aix-la-Chapelle, Düsseldorf, Arnsberg, the south of Hanover, south-west Saxony, Lusatia, &c. Manufacturing industries (including the building trades) gave employment to over 12,000,000 persons in 1895. The chief textile manufactures are those of linens, cottons, and woollens. The linen manufacture is to a certain extent domestic, and only used as subsidiary to other employments. In almost all the domestic looms only goods of a coarser description are made. Silesia, Brandenburg, and Westphalia are the provinces in which the linen industry is chiefly developed. The cotton manufacture has its chief seat on the Rhine, particularly in the neighbourhood of Düsseldorf and Elberfeld-Barmen, but is also carried on to a considerable extent in Westphalia and Hanover, in Silesia, particularly in the government of Breslau, and also in the province of Brandenburg. The woollen manufacture is carried on to a large extent domestically, but the manufacture properly so called has its chief seats in Brandenburg and the Rhenish provinces. Silk and velvet are made in the Rhine

valley, as also at Berlin. In connection with the above tissues, and properly forming branches of the same manufactures, vast quantities of linen, cotton, and woollen yarn are spun. The first is spun to a considerable extent by hand. The worsted is chiefly, and the cotton entirely, spun by machinery. The former has its principal seat in the province of Brandenburg, especially in the government of Frankfurt, and after it in the Rhine province. The cotton-mills are situated chiefly in the basin of the Rhine, and to a more limited extent in Silesia. The number of persons employed in the textile industries is about 430,000. The manufactures in metal employ over 500,000 persons. In iron and steel ware the first place belongs to the Rhine province and the Westphalian government of Arnsberg. Among particular localities may be specified Essen, for the celebrated steel works of Krupp, where gigantic cannon are made; Solingen for its fine saws and tools; Aix-la-Chapelle and Burscheid, Altena and Iserlohn for needles and pins; Remscheid and Hagen for locks and various similar kinds of hardware. Berlin has long been famed for its fine castings, many of which, whether as articles of ornament or utility, are unsurpassed. In connection with these may be mentioned type-founding, which, as well as printing, forms an important branch of industry in Berlin. The leather manufacture is important, and includes, besides ordinary leather, the finer varieties and parchment. Pottery in all its varieties forms an important industry. For porcelain and the finer kinds of ware Berlin and St. Martin, near Treves, are the most celebrated localities; excellent stoneware of a more common description is made extensively in the south of the province of Saxony, in Liegnitz, and in the Rhenish province. Common pottery is made in all the provinces, more especially in those of the east and centre. One of its most celebrated localities is Bunzlau. Glass does not rank high as a Prussian manufacture. The principal localities are the governments of Treves, Minden, and Oppeln. The most important paper-mills are in Silesia, Saxony, and Westphalia. Other manufactures carried on to such an extent as to be of national importance, are beet-root sugar, chocolate, chicory, chemical products, and tobacco. Of these the first is very important, being carried on chiefly in the provinces of Saxony, Hanover, and Silesia. The tobacco industry is also important, and is carried on in extensive factories in the Rhenish province, in Brandenburg and Saxony. The last manufactures deserving of notice are beer and spirits, the consumption of which is immense. The greatest number of distilleries is in the Rhine province, though Silesia has also a very large number. Of the breweries the Rhine province has above one-fourth. Sparkling wines are made near Coblenz and elsewhere.

Trade and Commerce.—The principal exports of Prussia are grain, flax, hemp, linseed, oil-cake, flour, sugar, timber, cement, linen and linen yarn, spirits, earthenware, chemicals, wool, woollen cloth, hosiery, iron, and zinc; the principal imports, coal and coke, chemicals, cotton and cotton twist, stone and building materials, iron and ironware, petroleum, grain, tea, oil and turpentine, raw hides, wine, herrings, salt, &c. The establishment of the Zollverein or Customs Union, by giving a free interchange of communication between the different states belonging to it, made it difficult to specify the exact amount of trade which each state possesses, but there cannot be a doubt that that of Prussia is very extensive. The Zollverein now embraces practically the whole of the empire, and also the Grand-Duchy of Luxembourg and the Austrian communes of Jungholz and Mittelberg. Both from the nature of the country and the number of navigable streams which inter-

sect it, it enjoys great natural facilities, and these have been very greatly extended both by common roads, canals, and railways. The last mode of communication has already made great progress. Prussia had on April 15, 1901, 19,088 English miles of railway belonging to or administered by the state, and 1436 miles owned and administered by private companies, making a total of 20,524 miles. The whole of the railways of Prussia will by and by become national property. The principal ports of Prussia are Memel, Pillau, Königsberg, Danzig, Colberg, Swinemunde, Stettin, Wolgast, Stralsund, Kiel, and Flensburg on the Baltic; and Altona, Harburg, Geestemunde, Leer, and Emden on the North Sea. The merchant navy of Prussia in 1900 consisted of 2074 vessels of 270,304 tons register, of which 513, of 191,412 tons register, were steamers. Among the foreign vessels which trade to Prussian ports the tonnage of Great Britain is about one-third more than that of any other nation. The second place is occupied by the Dutch, and the third by the Danes. In some of the ports shipbuilding is carried on with activity. Stettin builds about one-third of the whole.

Coins, Weights, and Measures. See GERMANY.

Government.—Prussia is a monarchy hereditary in the male line, and from the absence of recognized constitutional checks was, previously to the European revolutionary movement in 1848, in theory absolute. The present constitution was mostly framed by the government, with the aid of the constituent assembly, in 1849, and proclaimed 31st January, 1850. It has been modified by royal decrees, of which no fewer than sixteen were issued between April, 1851, and May, 1888. The sovereignty at present belongs to the house of Hohenzollern. The king, whose functions are both executive and legislative, attains majority at the age of eighteen. He is assisted by a council of ministers appointed by royal decree. A representative assembly composed of two chambers shares the legislative authority with the king. The consent of the king and of both chambers is necessary to all laws. Financial projects and estimates are first submitted to the lower chamber, and must either be accepted without amendment or rejected by the higher. Each branch of the legislature has the right of proposing laws. The upper chamber or House of Lords (*Herrenhaus*), as modified by decree of Oct. 12, 1854, is composed of princes of the blood of the reigning and former sovereign families of full age; about 100 heads of noble families, and over 200 other members, comprising great functionaries of the kingdom, representatives of towns, corporations, and universities, &c., nominated for life by the king. The second chamber or House of Deputies (*Haus der Abgeordneten*), since the enlargement of the kingdom, consists of 433 members. The primary qualification of electors is based on taxation, and is the same as for municipal elections. The primary electors are divided into three classes, according to the amount of their taxation. The first division consists of those who pay the highest taxation, the second who pay the medium, and the third of those who pay the lowest amounts; and the numbers in each division are determined by the total amount of taxation, which is equally distributed between the three divisions. The indirect electors (*Urwähler*) elect the direct electors (*Wahlmänner*), who choose the representatives. The deputies are chosen for three years, and the new members must be elected within six months of the dissolution of the chamber. The chambers are regularly convoked each November. Members accepting office must be re-elected. Members of the second chamber receive 20 marks (£1) a day, acceptance of which is obliga-

tory. A legal majority of members must be present when a resolution is decided on.

Finance.—The estimates of public revenue and expenditure submitted by the government to the chambers are now always made to balance each other, but the actual expenditure has in recent years usually been under the revenue, and sometimes there has been a very considerable surplus. Till 1876 the Prussian financial year was the same as the civil year, but at that date a financial year was adopted, ending, as in Great Britain, on the 31st of March. The revenue and expenditure for the year 1901-02 were each estimated at an amount equal to £132,450,000. The total debt by the budget of 1901-02 was £330,190,000. A certain part of the debt has been incurred for the construction of railways, and is a profit-bearing investment. The state-railways yield a very considerable proportion of the total annual revenue.

Justice.—The administration of justice in Prussia is similar to that in the other constituent states of the empire, and is regulated in its essentials by the Imperial law of Jan. 27, 1877, together with state laws of 1878. There is now but one code of commercial, criminal, and civil law throughout the whole empire, the unification having been completed by the formulation of the Civil Code which came into force on Jan. 1, 1900. The lowest courts of first instance are the *Amtsgerichte*, most of which are presided over by a single judge. Their jurisdiction extends to petty civil and criminal cases, and an appeal lies from them to the *Landesgerichte*, which have in addition an original jurisdiction, both civil and criminal. Above the *Landesgerichte* are the *Oberlandesgerichte*, or courts of second instance, of which Prussia has thirteen. A *Landesgericht* for criminal purposes has five, and an *Oberlandesgericht* seven judges. The supreme court of the empire (*Reichsgericht*) does not sit in Prussia, but at Leipzig. It has ninety-two judges appointed by the emperor on the advice of the *Bundesrath*.

Religion.—Though the reigning family is Protestant there is no exclusive religious establishment. The principles of religious toleration are professed, and persons of all denominations are alike eligible for public employment, and possess the same civil rights. The state, however, distinctly recognizes the two great bodies of Protestants and Roman Catholics, not only protecting them in their respective rights and properties, but directly interfering in their affairs, more especially in regard to the appointment and payment of their ministers, and to their general management. The Evangelical or Protestant church, formed in 1817 by a union of the Lutheran and the Calvinistic bodies, is governed by consistories, one for each province, at the head of which are superintendents. The Roman Catholics are governed by two archbishops, two prince-bishops, and seven bishops. The Old Catholics have a bishop in Bonn. According to the census of 1900 the number of Protestants was 21,817,577; of Roman Catholics, 12,113,670; of other Christians, 139,127; and of Jews, 392,322. The Protestants predominate in East Prussia, Brandenburg, Pomerania, Saxony, Schleswig-Holstein, Hanover, and Hesse-Nassau.

Education.—Elementary education is general and compulsory, and since 1888 it has been entirely free. Elementary schools (*Folksschulen*) must be maintained in every town or other local district, supported by the local rates, and assisted, if necessary, out of state funds. The school age is legally fixed as from six to fourteen. There are also *Fortbildungsschulen*, or continuation schools, for the children of the working-classes, open generally in the evening.

The middle and higher middle schools (*Bürgerschulen* and *Höhere Bürgerschulen*) represent a transition stage between the elementary and the higher schools, and have as their special object the education with a view to their ultimate position in life of the children of the lower middle classes. The higher schools comprise *gymnasias*, classical schools with a nine years' course; *progymnasias*, similar to the former but without the highest classes; *real-gymnasias*, gymnasias in which Greek but not Latin is taught, and in which modern subjects are given more prominence; *real-progymnasias*, like the preceding, but without the highest class; *real-schools*, in which classics are wholly omitted; and *upper real-schools*. Higher schools for girls are known as *Höhere Töchterschulen*. There are also numerous normal schools. Pupils in many of the higher schools are exempted from the usual term of military service on volunteering to serve for one year at their own expense. The crown of the educational system of Prussia is the excellent university organization. There are ten universities, located at Berlin, Bonn, Breslau, Göttingen, Greifswald, Halle, Kiel, Königsberg, Marburg, and Münster. Most have the usual four faculties, namely, theology, law, medicine, and philosophy (arts), but in Bonn and Breslau there are two theological faculties, a Protestant and a Roman Catholic. The theological faculty in Münster is Catholic, and there is a Catholic theological faculty at Braunsberg. The number of professors and teachers in Prussian universities is about 1560, and the number of students about 22,000. The 36,138 public elementary schools have in all 82,182 teachers and 5,236,826 pupils.

Prussia has also a well-developed system of technical education, running parallel to and in some measure linked with the system of general education. At the head of the technical schools of the kingdom are the *Technische Hochschulen* at Berlin, Hanover, Aachen, and Danzig, with about 6400 pupils, which are the universities of technical instruction with several technical faculties. In addition to those numerous technical schools which correspond to the secondary and primary schools of the general system, there are forestry schools at Elberswalde and Münden, technical mining schools at Berlin and Klausthal, agricultural high schools at Berlin and Poppelsdorf, veterinary high schools at Berlin and Hanover and many other similar institutions.

Army and Navy. See GERMANY.

People.—The far greater part of the people are Germans, but in several quarters the Lithuanian and Slavonian stocks preponderate. Thus, in the north-east corner of the monarchy, between the Deine, Angerap, Goldapp, Pregel, and the Instet and Memel, Lithuanian is spoken, read, written, and taught. The Slaves occupy the south parts of Gumbinnen, Königsberg, and Marienwerder, the greater part of Posen, and no inconsiderable part of Silesia. French are found chiefly in the west part of the monarchy, but partly also in the province of Brandenburg, where they are descendants of the French Protestants who found an asylum here from the tyranny of Louis XIV.

History.—The Kingdom of Prussia, which, in the second half of the nineteenth century, and before the re-formation of the German Empire, possessed the most powerful organization and wielded the greatest and most compact military strength of any state in Europe, dates only from the beginning of the eighteenth century. The antecedent history of the growth of this state into a kingdom is divided, by the natural order of the circumstances from which it is derived, into two branches. The more important of these follows the rise of the Electorate of Brandenburg,

which formed the nucleus of the future kingdom, and contained the principle of unity and the germs of vital organization which directed its growth. The other and less important branch relates to the province of Prussia, which incidentally gave its name to the kingdom, and which in one direction determined its external relations.

During the southern migration of the Teutonic races on the decline of the Roman Empire, the northern part of Germany as far west as the Elbe, and including the modern Brandenburg, was occupied by people of Slavonic race. When the divided empire of Charlemagne made way in the ninth century for a German kingdom military marches were established for the defence of the frontiers. Brandenburg, which had been conquered by Charlemagne in 789, was erected into a margraviate by Henry I. (the Fowler), king of Germany, in 926. Otto I. founded the bishoprics of Brandenburg and Havelburg. Albert the Bear, who received Brandenburg as a fief from the Emperor Lothaire (1134), conquered the Slavonian Wends, and took in 1157 the title of Margrave of Brandenburg. He also held the dignity of archchamberlain of the empire, which conferred the electoral dignity. He began the colonization of the country with German immigrants, which was continued under his successors. His dynasty continued to bear rule till 1320, and during this period German civilization was gradually extended in Pomerania, Saxony, Brandenburg, and Silesia. After its extinction there followed a period of anarchy. Brandenburg fell as a lapsed fief to the empire, and Louis of Bavaria gave it to his son. It continued in the Bavarian house for three successive electorates or reigns, and during this period it was named as one of the principalities to which the electorate was restricted by the Golden Bull (1356). It was subsequently ceded to the house of Luxemburg, and Charles IV., the first imperial representative of this house, gave it successively to his sons Winceslaus (1373) and Sigismund (1378). Sigismund sold the New March to the Teutonic knights in 1402, and twice mortgaged the Electoral March for his debts. On the second occasion, after he had become emperor, he received from Frederick, the burgrave of Nürnberg, a loan of 400,000 gold florins, for which the latter held Brandenburg in pawn for some years. The emperor then formally agreed to cede the electorate in liquidation of his debt, and Frederick, to whom the exchange was acceptable, was duly invested in it at the Diet of Constance in 1417, two years after John Hus had been burned by the decree of the council assembled at the same place. Sigismund was not aware that he had sold the reversion of the empire to a house who should become the champions of a creed similar to that for which Hus suffered, but to this result, through many remarkable vicissitudes, the course of events finally tended.

The burgrave who had acquired the electoral dignity in this mercenary manner was the descendant of Conrad of Hohenzollern, a cadet of a Swabian house, who had received in 1200 the appointment of imperial burgrave of Nürnberg, which had become hereditary in his family. The elder branch of the family continued to hold a small territory surrounding the ancestral castle of Hohenzollern, of which they traced their lordship back to the time of Charlemagne, till 1851, when they ceded it to Prussia, and were recognized as princes of the blood.

The territory which Frederick had acquired had relapsed under its imperial rulers into a condition of disorder and lawlessness. The feudal nobility had made themselves nearly independent. As in other parts of Germany they had covered the country over with their strongholds, which were little better than

the abodes of robbers. Frederick protected the towns from their depredations, and gradually reduced their castles. Before his purchase of the electorate he had acquired two small territories in Franconia, Ansbach, and Baireuth, the consequent union of which with the Kingdom of Prussia subsequently gave rise to important events. Frederick divided his possessions among his sons; the second, Frederick, succeeded to the electorate, and subsequently reunited the territories belonging to it. Frederick II., who succeeded his father in 1440, and who was surnamed the Iron-mouthed, in honour of his military prowess, extended the possessions of his family by policy as well as by valour. He repurchased the New March from the Teutonic knights, to whom it had been sold by the Emperor Sigismund. In 1470 he abdicated in favour of his brother Albert III., surnamed Achilles, who, by a family ordinance (*Hausgesetz*), prepared the way in an important respect for the future greatness of his house. In our article GERMANY (see subdivision on the internal divisions and government of the empire) we have noticed the prevalence, even in the larger fiefs of the empire, of the partition of inheritances among heirs of like degree as a cause of political division, which, from the federal constitution of the empire and the quasi-independence of its princes, proved a source of weakness not only to the houses which adopted it, but to the entire state. This practice had been introduced in the Hohenzollern line of Brandenburg by its founder. The *Hausgesetz* provided for the undivided descent of the marches in connection with the electorate. Ansbach and Baireuth were permitted to go to separate heirs, but not more than two. A hereditary succession was thus secured, which, in the fluctuating state of other German houses, eventually made the house of Brandenburg an adequate rival to the imperial Austrian house, while the circumstance that the hereditary possessions of the former lay chiefly within, while those of the latter lay chiefly without the limits of Germany proper, finally turned the scale in favour of the more recently formed power. Albert resigned the active administration of the government to his son John Cicero in 1476. He died in 1486. John I. was succeeded in 1499 by his son Joachim I., who reduced the last strongholds of his recalcitrant nobility. He founded the first university in the electorate, that of Frankfort-on-Oder, in 1506; and he established a supreme legal tribunal (*Kammergericht*) at Berlin. He zealously opposed the Reformation, which during his reign spread rapidly in his dominions. In 1510 he expelled the Jews from his territory. His son Joachim II., who succeeded in 1535, embraced the Reformation, and established Lutheranism in 1539. This step also exercised an important influence on the fortunes of the house. Joachim acquired the title of Hector from the valour he displayed in the Turkish campaigns as imperial generalissimo. He confiscated the Catholic bishoprics of Brandenburg, Havelberg, and Lebus, and applied their revenues to the endowment of schools. In 1537 he signed with Duke Frederick of Liegnitz a hereditary union (*Erbverbrüderung*), by which the reversion of the principalities of Liegnitz, Brieg, and Wohlau was secured to the Hohenzollern house. The Seven Years' war and the acquisition of Silesia by Frederick II. of Prussia were the ultimate results of this agreement. He also acquired a title to the Duchy of Prussia, which will be afterwards alluded to. John George succeeded in 1571. He administered his states with a view to relieve them of financial embarrassments entailed by the profuse expenditure of his father. By welcoming the Dutch, who were driven from their country by persecution, he contributed to the industrial prosperity of his country.

Joachim Frederick, who succeeded in 1598, married (1603) his son John Sigismund to the daughter of Frederick Albert, duke of Prussia. He effected in 1603 with his cousin George Frederick of Ansbach, on the basis of the *Hausgesetz* of 1477, the House-treaty of Gera, which was afterwards considered the fundamental law of the family. He was succeeded in 1608 by John Sigismund, who united the Duchy of Prussia to the electorate in 1618, and brought Brandenburg into contact with Poland.

We shall here give a separate outline of the history of this province to the point of junction. The coast territory between the Vistula and the Niemen was early occupied by a Lithuanian race called Prussians, whom the kings and clergy of Poland had long endeavoured to convert to Christianity. Probably the methods taken were not always of the most forbearing kind, and the Prussians returned the attentions bestowed on them by inroads on the Polish territory, which eventually became so alarming that the Poles called in the Teutonic knights of St. George to help them against their heathen neighbours. Having obtained on behalf of their order a grant from the emperor of all the Baltic lands they should conquer, the Teutonic knights began a war of conquest in 1231 under their general, Herman von Bulek. The conquest was completed in 1283. The Teutonic knights removed their head-quarters from Venice to Marienburg. They did much to civilize the country and introduce the peaceful arts of agriculture and commerce. They reached their greatest prosperity about 1400, when fifty-five walled cities and forty-eight castles, with a large agricultural population, owned their sway. Their rule, however, was attended with the disadvantages of a despotic oligarchy. The Lithuanians united with the Poles against them, and they were defeated by Jagellon in the battle of Tannenberg, 15th July, 1410. Internal dissensions followed their defeat, and their power gradually declined until the conquests of the Poles compelled them in 1466 to accede to the Treaty of Thorn, by which West Prussia was ceded entirely to Poland, and East Prussia held by the grand-master as a fief of the Polish crown. The Teutonic order now sought the protection of the German princes by electing acions of the great houses to the grand-mastership. Margrave Albert of Brandenburg-Kulmbach, a nephew of Sigismund, king of Poland, was chosen grand-master, and installed in 1512. He refused to do homage to the King of Poland, who declared war on him in 1519. It was terminated by a four years' truce in 1521 through the mediation of the emperor and the King of Hungary. In 1524 Albert swore allegiance to the empire, and took his seat in the Diet of Nürnberg as an ecclesiastical prince. On the termination of the truce with Poland in 1525, Albert, who had embraced the Reformation, negotiated a treaty with his uncle, by which he renounced the ecclesiastical profession and received the investiture of the King of Poland as hereditary Duke of Prussia under the Polish crown, with the right of succession to all the possessions of the Teutonic order. Albert founded the University of Königsberg and established schools throughout his duchy. His son Frederick Albert succeeded in 1568. He became hopelessly lunatic, and his states had to be administered by a regency, which from 1608 was conducted by his son-in-law, the Elector John Sigismund, whose grandfather had, as already mentioned, acquired the co-enfeoffment of the duchy. On his death in 1618 the duchy was united with Brandenburg.

About the same time another important accession of territory was gained by the same elector. John William, duke of Juliers, Clèves, and Berg, Count of La Marck and Ravensberg, and Lord of Raven-

stein, died without issue in 1609. There were numerous claimants to the succession, among whom, in virtue of his wife, was John Sigismund. By the Treaty of Xanten (1614) Cleves, La Marck, and Ravensberg, being half the succession, were assigned to Brandenburg. Thus was laid the foundation of the Rhine province, which brought the future kingdom in contact with France. John Sigismund again changed the religion of his state by renouncing the Lutheran for the Calvinistic confession. He was succeeded in 1619 by his son George William. That terrible crisis in the affairs of Germany, the Thirty Years' war, had now arrived. George William was unequal to the occasion. His continued vacillation between the two parties probably contributed to protract the war, and brought all the evils of military occupation and exaction upon his own states from both sides, each of whom alternately treated him as an enemy. At first he adopted the side of his brother-in-law Gustavus Adolphus, but was soon swayed from it by his minister Count Schwarzenberg, a Catholic and partisan of the house of Austria. Even while he remained at peace with the emperor, Tilly and Wallenstein traversed his states and levied contributions from them unsparingly. Mansfeld and Gustavus Adolphus occupied them in turn, and he was compelled to cede to the latter the fortresses of Spandau and Küstrin. He afterwards took the side of Gustavus, but on his death made peace with the emperor, and again exposed his states to the incursions and exactions of the Swedish generals, who traversed them at their pleasure, and remained in occupation of them at his death in 1640. Thus a crisis which in the hands of a bold and skilful leader might have made the fortune of the rising state, brought it to the brink of ruin. At his death whole tracts of country were depopulated, agriculture was neglected, trade and commerce abandoned. It is rarely that such opportunities are lost with impunity, but fortune did not yet abandon the house of Brandenburg. Frederick William, son of the preceding, surnamed the Great Elector, and who may be regarded as the virtual founder of the Prussian monarchy, averted the progress of calamity, and soon gave a prosperous turn to the affairs of the state. Through the jealousy of Count Schwarzenberg he had passed his youth far from the court, and had been trained to arms in the camp of Frederick Henry, prince of Orange. A fuller account than we can here give of his reign will be found in our biographical article under his name. He began by concluding a treaty of neutrality with Sweden, by which he freed the electorate from hostile occupation. The Rhine province he cleared by armed force. At the Peace of Westphalia (1648) he was compelled to cede West Pomerania and the Island of Rugen to Sweden, and received in exchange the bishoprics of Halberstadt, Minden, and Kammin, with the reversion of the Archbishopric of Magdeburg and the lordships of Lora and Klettenburg. By the Treaties of Vehlau (19th September, 1657) and Oliva (28d May, 1660) he secured the recognition by Poland and Sweden of the independence of Prussia, and was recognized as sovereign by the Prussian states at Königsberg in 1663. Before securing the independence of Prussia he had, through the exigencies of war, transferred his allegiance from Poland to Sweden. He allied himself with the emperor and Holland against France and Sweden (1672), and conducted the war with remarkable vigour and success, but was compelled by the weakness of the emperor to make peace on disadvantageous terms by the Treaty of St. Germain en Laye (29th June, 1679). The Silesian principalities fell vacant during his reign, but the emperor refused to recognize his reversionary treaty-right, and appropriated them to himself as escheated fiefs.

Circumstances only permitted Frederick William to protest. He formed a standing army, and in order to provide for its maintenance he violated the laws and the feudal privileges of his subjects, deprived the estates of Brandenburg and Prussia of the right of granting supplies, and reduced their power to a nullity. He thus founded the despotic power which so long distinguished the Prussian monarchy. Frederick William towards the close of his reign actively interested himself in the contemplated expedition of the Prince of Orange to England. He had promised his support to William, and engaged to release Marshal Schomberg, who was in his service, whenever William should require him to aid in the expedition. Frederick William died 29th April, 1688, and was succeeded by his son Frederick, the third elector of that name, and the actual founder in 1701 of the Prussian monarchy. The time had now come when the prudence and foresight which had directed the energies of a succession of able rulers, though interrupted at a momentous crisis by one incapable reign, was to meet its natural reward. The Great Elector had steadily directed his efforts to the centralization of the power of his states, and to the placing of the central power upon an independent footing. Nominally subject to the German Empire for the bulk of his possessions, the weakness of the central power of the empire was brought so familiarly within the range of his own observation and experience, that it did not require his sagacity to anticipate the probability of its decline or extinction. In a federal elective monarchy where the central power was strong, the ambition of the more powerful members of the confederation might be expected to turn on the hope of securing the reversion of the supreme power, and nothing would be done without a strong counter-motive to weaken it. When in such a state the central power is weak, the possession of it implies danger, which those who have most to risk will commonly be most cautious of encountering. The strength of the central power of the German Empire had come to depend almost entirely upon the personal or hereditary possessions of its holder. When this is the case the risk is greatly increased by a transfer of power. The probable enmity or opposition of an excluded claimant, who, as the heir of the former holder, would imagine his right to be preferable, and the reluctance of the partisans of the old power to change their allegiance would at least have to be reckoned with. In such circumstances the ambition of the more powerful houses will naturally tend to independence, and this may explain how the elective succession continued almost without interruption in the line of Austria, which had become by far the most powerful of the German houses in respect to the extent of its hereditary possessions, while the central power itself, as represented by the diet, in which the influence of Austria was paramount, became gradually weaker. The final renunciation by Austria herself of the imperial power, together with the absorption of many of the weaker states by the stronger, though brought about by external events of the most violent kind, was not an unnatural issue of the internal organization of the empire itself. But of the German states, with the exception of Austria herself, none had been more successful in extending its power than the Electorate of Brandenburg. Its possessions lay more within the natural limits of the empire than those of the imperial house, and they had been consolidated as far as their situation admitted by the Great Elector into a homogeneous body. The electorate had thus become a kingdom in all but in name. It was a rising kingdom within a declining empire, and it was natural to wish that the name and rank of the state should correspond with its

means and power. This was the ambition of the new elector, and he found means to gratify it. Among the first acts of the elector were to join the Grand Alliance against France, in which, like his father, he was influenced by religious as well as by political views, and to do all in his power to forward the enterprise of the Prince of Orange, who was his uncle, on England.

Soon after the termination of the first war of the Grand Alliance (Peace of Ryswick, 1697) the elector entered into a treaty with the emperor, by which he received permission to assume the title of king in connection with his ex-German principality of Prussia. By this treaty, called the Treaty of the Crown, he engaged to support Austria in the diet, to give his electoral vote in favour of the emperor's son, and to maintain for the service of the empire an army of 10,000 men. These conditions, for the fulfilment of which there could be no guarantee, show as clearly the weakness of the emperor as the ambition of the elector. Frederick immediately proceeded to Königsberg, and crowned himself King of Prussia on the 18th of January, 1701. The second Grand Alliance was concluded against France in September of the same year. In spite of the exertions of the emperor, the Elector of Bavaria and other German princes joined the French alliance, but the new Kingdom of Prussia sided with Austria and England, and the Prussian troops distinguished themselves by the side of the English at Blenheim, Ramillies, Oudenarde, and Malplaquet. Frederick died in 1713. His son, Frederick William I., an arbitrary and ignorant, but well-meaning despot, governed Prussia till 1740. His reign was on the whole peaceful, and as he did not neglect the material prosperity of his subjects, the country grew greatly in population, industry, and wealth. His parsimony enabled him to fill the public treasury without oppressing the country. His chief passion was for military drill, and he had a particular mania for cultivating a corps of tall soldiers. He went to war with Charles XII., and acquired part of Pomerania, with Stettin, from Sweden. He gave a dubious and lukewarm assistance to the emperor in the war of the Polish Succession. He left at his death a prosperous country, a well supplied treasury, and an army of 70,000 men to his successor. Frederick William has acquired the greater part of his renown from his treatment of his son. The king was a very strict Calvinist, and endeavoured to bring up his family with the most scrupulous attention to their religious principles, but he was indifferent, or rather hostile to learning, and he proposed in his son's education to leave out the study of the classical languages, history, and literature. Frederick, who had acquired some literary tastes, was as much opposed to his father's plans as he was averse to the strictness of the discipline to which he was subjected. Having failed in an attempt to leave the country, he was banished from court. His father tried to induce him to renounce the succession, and but for the interference of the emperor, would probably have put him to death. Frederick II., surnamed the Great, who succeeded to the crown on the death of his father in 1740, was in many respects a contrast to his Lutheran and Calvinistic ancestors. The bigotry of his father had, by a natural reaction, driven him to indifference and scepticism in religion. His literary tastes had brought him into intimate and sympathetic relations with the philosophic liberalism of France. During his exile from court he patronized scholars and corresponded with Voltaire. The Emperor Charles VI. died on the 20th of October, 1740, and left his hereditary possessions to his daughter Theresa, and with them the Silesian principalities, which had been appropriated

under protest of the Great Elector. The troubles which the succession of Maria Theresa was likely to occasion afforded Frederick the opportunity of enforcing his claim. He had been preparing for war from the time of his accession, without having definitely fixed on any object but the acquisition of glory (*'La satisfaction de voir mon nom dans les gazettes'—Letter to Jordan*). He invaded Silesia without ceremony, and then made proposals of alliance to Maria Theresa, which were rejected with indignation. The first encounter of his troops with the Austrians had very important results, for it showed the decisive superiority of the Prussian discipline and drill. In the matter of rapidity of firing their advantage appears to have been then as great as in the modern battle of Sadowa. Frederick was persuaded to flee on a preliminary defeat of his cavalry, and learned at Lowen that his troops had gained the battle of Mollwitz, 10th April, 1741. At the persuasion of England Maria Theresa entered into negotiations with him, but failed in coming to an understanding, and Frederick, in a secret treaty with France, 5th June, 1741, acceded to the league formed against her by the Treaty of Nymphenburg, stipulating for a recognition of his right to Lower Silesia. By a treaty begun at Breslau, June 11, and concluded at Berlin, July 28, 1742, Frederick obtained from Maria Theresa, on condition of neutrality, the cession, with the exception of some specified districts, of both Upper and Lower Silesia, and of Glatz. Taking alarm at certain treaties concluded by Maria Theresa, which seemed to threaten an attempt to reconquer Silesia, Frederick entered into an alliance with the Emperor Charles VII. (the Elector of Bavaria, who had been unanimously chosen at the Diet of Frankfurt, January, 1742), who had been driven from his dominions by the Austrians, and whom Frederick undertook with the assistance of France and Sweden to restore. It was secretly stipulated that Bavaria was to have Bohemia and Prussia Silesia. This treaty, called The Union of Frankfurt, was signed by the emperor, the king, and other German princes, 22d May, 1744. In August Frederick invaded Bohemia, and commenced what is called the Second Silesian war. Prague surrendered to him on 16th September, but ill-supported by the allies, whom he had formerly deserted, he was compelled to retreat before the Austrians and Saxons. The Union of Frankfurt was opposed by the Quadruple Alliance, including Austria, Great Britain, the Netherlands, and Poland and Saxony. In 1745 Frederick gained victories over the Austrians at Striegau, June 4, and at Sorr, September 30, but the death of the Emperor Charles VII. (January 20) had broken up the alliance, and the English ministry exerted themselves to restore peace. Maria Theresa was unwilling to come to terms, but the continued success of the King of Prussia, who had invaded and conquered Saxony, compelled her to listen to the remonstrances of her allies. Peace was concluded at Dresden, 25th December, 1745. Saxony paid a subsidy to Prussia, and Austria confirmed the cession of Silesia, which was guaranteed by Great Britain. Frederick acknowledged Francis I., the husband of Maria Theresa, as emperor. Frederick acquired East Friesland by the death of the last prince in 1744. The war of Succession was continued by France till the conclusion of the Treaty of Aix-la-Chapelle, October 18, 1748. It was followed by the Seven Years' war, upon which the military fame of Frederick mainly rests. The Treaty of Dresden had aroused in the mind of Maria Theresa a feeling of resentment against Great Britain. The steady support which that power had lent her in the defence of her throne was dearly purchased in her eyes by

the constraint which had been put on her in regard to the surrender of Silesia. Her minister, Count Kaunitz, had formed the scheme of uniting France and Austria, the opposing principals in the late war against Prussia. War was pending on an American question between France and England. Russia was courted by both sides, and the Empress Elizabeth made an alliance with Great Britain for the purpose of receiving one of the liberal subsidies which it had become the custom of that power to grant to her allies, but with the intention of turning against her when the war began. A secret alliance was already in existence between Russia and Austria, providing in the event of any aggressive movement on the part of Prussia against either for the revival of the Austrian claim on Silesia. Prussia was in the meantime prospering through the interval of peace, and Frederick was desirous to maintain it. He also was solicited by both France and England. Not suspecting the possibility of an alliance between Austria and France, and being treated with too little ceremony by the latter, he chose the English alliance. His treaty of neutrality with England (16th January, 1756) enabled Kaunitz to press with more effect his alliance upon the French court. Among other extensive projects his scheme embraced the partition of Prussia. Austria was to have Silesia and Glatz; Russia, Courland; Poland, Prussia; Saxony, Magdeburg; and Sweden, Pomerania. France concluded a treaty of neutrality and mutual guarantees with Austria in May, 1756. Before the schemes of his adversaries were matured Frederick resolved to anticipate them. He wrote to George II.: 'It is better to anticipate than to be anticipated.' In August, 1756, he invaded Saxony, entered Dresden on 7th September, and published the despatches which proved the existence of the scheme to partition Prussia. England now openly entered into a defensive alliance with Frederick, and subsidized him. The allies, whose plans had been discovered, Austria and the empire, France, Russia, and Sweden prepared for immediate hostilities. The Diet, on the complaint of the Elector of Saxony, declared Frederick guilty of a breach of the *Landfriede*, or peace of the empire, and granted a threefold contingent of troops against him, but the Northern States protested against the decision, and hired their troops to England for the assistance of Prussia. The general course of events of this war will be more fully noticed in an article on the SEVEN YEARS' WAR. The immense forces which his enemies were able to bring into the field reduced Frederick to the greatest straits, and gave opportunity for the development of the high qualities of strategic genius, moral firmness, and patriotic devotion, which have placed his name among the world's heroes. Towards the close of the war the English cabinet began to draw off from the Prussian alliance, but the death of the Empress Elizabeth, January 5, 1762, broke up the alliance against Prussia, and the Peace of Hubertsburg, 15th February, 1763, confirmed the Treaty of Berlin. According to Frederick's calculation 886,000 men had perished in a war which failed in effecting any territorial change. Its moral result was that Prussia was now regarded as one of the great powers of Europe. The Seven Years' war was certainly brought upon Prussia by the conduct of Frederick himself at the beginning of his reign, which had aroused the resentment of Maria Theresa; but the danger being averted, it was now to be seen what impression had been made on Frederick by the lesson he had received against encouraging aggressive designs. During the war Frederick had declared that the independence of the Polish Republic depended on the power of the House of Brandenburg. Cath-

arine II. had now formed the scheme of partitioning Poland and invited the co-operation of Frederick. The Poles, on the other hand, were willing to elect a sovereign from his house. But Frederick could not afford to encounter the hostility of Russia, he therefore entered into a treaty with Catharine II., April, 1764, for regulating the affairs of Poland, and placing Stanislaus Poniatowski on the throne, which was effected by Russian and Prussian arms. The rapid advance of Russia in her war with the Turks subsequently aroused the jealousy of Prussia as of other powers, and brought Frederick into conference with the Emperor Joseph II. Two interviews took place at Neisse, in Silesia, in August, 1769, and Neustadt, in Moravia, in September, 1770, and it seems probable, although authorities differ on the subject, that the terms of the partition of Poland were discussed at these interviews. Immediately after the last of them some districts of Poland, of which Austrian troops had already taken possession, were declared reunited to the Kingdom of Hungary. About the same time the Prussians, on a frivolous pretext, violated the boundaries, and invaded the territories of the republic. Negotiations were then entered into with Russia on the double subject of peace with Turkey and the partition of Poland. The intrigues of the various powers engaged in this transaction belong more properly to the history of Poland. Russia and Prussia made a separate treaty, 17th February, 1772, and on 5th August, 1772, the terms of the partition were arranged in a triple treaty between the three powers. Prussia obtained all Pomerania, except Danzig and its territory, and a portion of Great Poland extending from the New March to Fordon and Solitz on the Vistula, and to the river Netze, together with the greater part of Western or Polish Prussia. The union of West Prussia with the kingdom was of the greatest importance, as it had hitherto broken the communication between the possessions of the new monarchy in a most awkward way. The Bavarian succession, thrown open by the extinction of the direct line, induced a war between Austria and Prussia in 1778 and 1779. In the negotiations for the settlement of this question at Teschen, 13th May, 1779, the annexation of Ansbach and Baireuth to Prussia, on the extinction of the direct line, was provided for. A league called the *Furstenbund* was formed by Frederick to uphold the terms of the Peace of Teschen, into which George III. entered as Elector of Hanover. Frederick died 17th August, 1786. The latter part of his reign had been on the whole one of peace and of great growth and prosperity on the part of Prussia. For his private character see the biographical notice under his name. The early dangers of his reign had led to one peculiarity in his views, which tended to retard the development of the country's resources. He had an aversion to good roads as a means of opening up the country to an enemy. His other economical projects were such as in the opinion of the day were best adapted for promoting the industrial prosperity of the kingdom. In religion he established complete toleration, being indifferent to the opinions held by his subjects regarding it. The *Landrecht*, or Prussian code of laws, though not published during the reign of Frederick, was prepared by his chancellor, Count Karmer.

Frederick was succeeded by his nephew Frederick William II. In 1787 he reinstated the Prince of Orange, by an armed intervention, in the stadtholdership of Holland, and in 1788 concluded a defensive alliance with England and Holland, known as the Triple Alliance. The commencement of Frederick William's reign had been hailed by his subjects in hope of some relaxation of the despotism of their

princes, but these hopes were doomed to disappointment. The Religionsedict and the Censuredict, issued in 1788, showed that intolerance was again to prevail in matters in which it had been relaxed. The affairs of Turkey occasioned serious differences between Austria and Prussia, which on the accession of Leopold I. had nearly resulted in war, but were peaceably arranged by the Convention of Reichenbach, August 5, 1790. All eyes were now turned on the progress of the French revolution. Frederick William especially exerted himself in the cause of Louis XVI., and on 27th August, 1791, he issued, in conjunction with the emperor, the famous declaration of Pilnitz, summoning the European powers to his aid. The principalities of Ansbach and Baireuth were, towards the close of this year, incorporated with Prussia, being ceded to the crown by the margrave. In 1792, war having already been declared by the French authorities against the empire, the Prussians, under the Duke of Brunswick, invaded France. They were defeated by Kellerman at Valmy on 20th September. Jealousy of Austria, and disagreements with that power about the affairs of Bavaria and Poland, soon induced Frederick William to withdraw from active co-operation in the war of which he had been the prime mover, notwithstanding that he had just concluded a treaty with England for the prosecution of the war. What remained of Poland after the last partition had fallen almost completely under Russian influence. The attempts of a patriotic party in Poland to throw off the yoke formed the pretext of a new partition. An understanding was come to by the partitioning powers on 4th January, 1793, and twelve days after a Prussian army entered Great Poland. A declaration, charging the inhabitants of Danzig with holding revolutionary opinions and entertaining unfriendly feelings to Poland followed (24th February). The city was blockaded and taken, 8th April. A proclamation or patent was also issued on 25th March to the inhabitants of the Palatinates of Posen, Gnesen, Kalisz, Sieradz, Lentschitz, Rava, Plotzk, and some other districts, including the towns of Danzig and Thorn, that they were henceforth to consider themselves as Prussian subjects. By the Treaty of Grodno, signed 25th September, 1793, the Republic of Poland ceded the provinces already seized to Prussia. The third partition of Poland, 25th November, 1795, followed the suppression of the insurrection headed by Kosciuszko. Prussia obtained the portions of the Palatinates of Rava and Plotzk not previously occupied, parts of Masovia, Podlachia, Troke, and Cracovia, including Warsaw. This distribution was modified subsequently through the Napoleonic wars. On 25th April, 1795, Frederick William entirely abandoned the coalition, and signed the Peace of Basel with the French Republic. By this treaty Prussia offered herself as mediator for the princes of the empire, thus encroaching on the privileges assigned by the German constitution to the emperor. A line of neutrality which should save North Germany from invasion was stipulated for. In the crisis of the eventful campaign of 1796 this treacherous policy was carried still further. A new line of neutrality was formed, and the states included in it were induced to withdraw their support from the imperial armies, while by a secret treaty Frederick William agreed to allow the French to advance their frontier to the Rhine, compensation for himself and other secular princes being provided by the secularization of ecclesiastical domains in Germany. Thus was anticipated the policy of Napoleon in forming the Confederation of the Rhine. By this treaty Saxony, among other powers, was induced to withdraw her support from the empire. Frederick William, worn out

with debauchery, died on 16th November of the year (1797) following these disgraceful transactions. His successor, Frederick William III., retained the principal advisers of his father, but one of his first acts was to repeal the intolerant edicts passed in the late reign. He continued his father's policy in regard to France, and courted the French directorate, who showed more deference to their open enemy Austria than to their truckling ally; but when the Peace of Lunéville (1801) extended the French territory to the Rhine, Prussia was indemnified by 4116 square miles ceded to her at the expense of the empire. In 1804 Prussia recognized Napoleon as emperor of France, the Emperor of Germany taking at the same time the title of Emperor of Austria. During the same year Frederick William attempted to negotiate between France and Russia, and he remained neutral in the campaign which ended in the overthrow of Austria at Austerlitz, December, 1805. Napoleon had, however, in 1804, offended his pride by marching his troops, in spite of remonstrance, against the Austrians through the Prussian territory of Ansbach and Baireuth. He was preparing to join the allies when the victory of Napoleon anticipated him. The conqueror now compelled him to accept of Hanover in exchange for Ansbach, Baireuth, Cleves, and Neufchâtel ceded to France and Bavaria. Frederick William now occupied Hanover, which by a patent he declared annexed to Prussia in virtue of cession by the Emperor of France, to whom it belonged by right of conquest. This step embroiled him in war with Great Britain and Sweden. The tactics of Prussia were now turned against herself, and by the formation of the Confederation of the Rhine, which led to the dissolution of the empire, Prussia also was isolated in Germany. Napoleon indeed suggested to Frederick William the formation of a rival association, and even offered to support him in assuming the imperial crown; but he thwarted his efforts to form the new alliance, and threatened the princes who were solicited to join it. A still more flagrant expression of contempt filled up the measure of the endurance of the Prussian court. In his negotiations for peace with England Napoleon offered to restore Hanover. In the blindness of the indignation excited by this insult all considerations of prudence were forgotten, and Prussia, which had hesitated to encounter France with England and Austria as allies, now resolved to rush upon the danger alone. Her previous tergiversations, in fact, deprived her of the hope of allies among her German neighbours, and it is known that Napoleon, seeing her isolation, had deliberately provoked her to her overthrow. The Prussian army was immediately placed on a war footing. Peace was made with Sweden, and negotiations opened with England, but the disposal of Hanover was delayed till the result of the campaign should show whether Prussia was strong enough to contend single-handed with France. If she proved strong it was to be kept; if weak, it was to be exchanged for English subsidies. The Prussian army amounted to 180,000 men. It had the prestige inherited from the wars of Frederick II., and was commanded by the Duke of Brunswick, whose reputation dated from the Seven Years' war; but it had seen little service, and had to cope with the veterans of Marengo and Austerlitz led by Napoleon in person. The French emperor too, aided by the contingents of the Confederation of the Rhine, was able to bring a numerical superiority of force into the field. The Emperor of Russia had promised his aid to Prussia, but it could not arrive in time. Still the Prussians were sanguine and enthusiastic. The war party was headed by the youthful queen, who inspired the troops with a chivalric devotion. But

the single battle of Jena (Jena and Auerstädt, fought the same day, 14th October, 1806, may be regarded as one battle) dashed these delusive hopes, and laid the country prostrate at the feet of the conqueror. Before deciding the fate of Prussia Napoleon pushed on to meet the advancing Russians, and it was only at the Peace of Tilsit, concluded between him and the Emperor Alexander in June, 1807 (signed 7th-9th July) that he condescended to make known his terms to his former ally. Prussia was dismembered, and was spared as a kingdom only at the intercession of the Russian emperor. Her possessions west of the Elbe, including Hanover, had to be ceded to the Kingdom of Westphalia, formed for Jerome Bonaparte. The Grand-duchy of Warsaw, and the circle of Kotbus in Lusatia, were transferred to Saxony, which was raised to a kingdom. Danzig was restored to independence, or rather to dependence on France. East Prussia was assigned to Russia. All that was left to Prussia of her Polish acquisitions was Ermland and part of the district of Netze. A war indemnity of 140,000,000 francs was imposed on the mutilated kingdom, and the fortresses of Glogau, Küstrin, and Stettin were to be delivered over to French garrisons maintained at the expense of Prussia as security for its payment. Frederick William was further obliged to engage not to keep on foot an army of more than 42,000 regular troops during the next ten years. The ports of Prussia were closed against England.

These measures would seem, as far as human prudence could foresee, to be the most effectual that could be devised for the humiliation of a kingdom. In the event they proved that, however often coercion may succeed, it can never safely be relied on. The history of Austria presents more frequent instances of recovery from disaster than that of Prussia. We have now reached the second instance in Prussian history, and it is one which, taken in its entire magnitude, is perhaps unparalleled in the history of the world. The hopes of the Prussians, even when the blow was recent, were not crushed by disaster; and the anticipation which Blücher, after the battle of Jena, expressed in his professional metaphor, 'that now more enlightened principles would put their foot into the stirrup,' did not prove a vain one. The very measure which seemed most effectually to bar the recovery of Prussia, the restriction of her army till her lost possessions should accustom themselves to new masters, was the means of making her the greatest military power in Europe. Baron Stein, to whom the administration of the kingdom was committed, began to prepare it for meeting foreign exactions by internal improvements. The national crisis was taken advantage of to sweep away obstructions which would otherwise have long resisted the hand of the reformer. Feudal usages were abolished, and the sale and transfer of land made entirely free. Local self-government was accorded to the towns, and ancient restrictions on trade were swept away. The offices of state were likewise reformed, and adapted to practical requirements. In the midst of these reforms the jealousy of Napoleon compelled Baron Stein to resign his post (November, 1808). His work was carried on by Baron Hardenberg. A plan of evading the army restriction was formed by General Scharnhorst. Young men entered the army, and after acquiring the necessary drill returned into private life, leaving their places vacant for others. This operation was conducted so quietly that it came to light only in 1813. Such was the germ of the Prussian Landwehr. During the Russian campaign of 1812, Prussia, like other German states, was compelled to follow in the train of the military despot, who at this time commanded the resources of nearly

all Europe. In spite of the most obsequious behaviour she was still treated as a conquered enemy, and military exactions were freely made on her territory. A treaty was concluded, 12th February, 1812, by which Prussia engaged to support France with her arms, and was promised, in event of success, an addition of territory. When the disastrous termination of the Russian campaign was reached, it was the Prussian general York who, by the Convention of Tauroggen, concluded 20th December, 1812, with the Russian general Diebitsch, set the example of defection to the Germans. On 3d February the king issued a general call to arms, and 150,000 men were found to be at once disposable. A treaty with Russia was concluded on 27th February. Prussia undertook to provide 80,000 men for the war, exclusive of garrisons; and Russia engaged for the restoration of all the dominions of Prussia except Hanover. To the Prussian declaration of war the French minister replied by a history of the Prussian perfidies from the time of the revolution. The document was keen, but ill-timed, and little calculated to diminish the hostility of Prussia, which on the part of France had not been without provocation. Of the succeeding campaign, in which Europe was leagued against the oppressor, the particulars for which we have space have been given in the history of France. The names of Blücher, York, Gneisenau, and Bülow will recall the part taken in it by Prussia. Frederick William III. in person was present at Lützen and Leipzig. At the Congress of Vienna Hanover returned to England. Prussia demanded the whole of Saxony in compensation for the Duchy of Warsaw, on the plea that Saxony had been most opposed to the general cause. This demand was opposed by Austria, France, and England, and nearly led to a renewal of war. The congress was disturbed by the return of Napoleon, and in the campaign of 1815 Prussia, along with England, bore the brunt of the fight at Ligny and Waterloo. On the resumption of the congress Prussia received nearly the same territories as she possessed up till her recent acquisitions in the wars yet to be noticed.

After the restoration Frederick William III. leaned to the despotic councils of Austria and Russia, and did not carry out the reforming policy of his councillors in difficulty, Stein and Hardenberg. He joined the Holy Alliance, September 26, 1815, and continued a staunch adherent of it till death. The administration of affairs, though despotic, was vigorous, and on the whole successful. Compulsory education was made a fundamental principle of the state in 1816. Normal schools and gymnasia were endowed. A liberal mercantile tariff was established in 1818, but was afterwards superseded by the protective policy of the Zollverein. An attempt to heal the divisions of the Protestant church was begun in 1817. On the 31st of October the king, who was a Calvinist, took the communion in the Lutheran Church, and the term Evangelical was henceforward used officially in place of the party designations. Measures of coercion were, however, used to bring about the agreement which frustrated their own end. By a concordat with the pope in 1821 a Roman Catholic hierarchy, headed by two archbishops and six bishops, was established and provided with a fixed endowment from the state. Frederick William died 7th June, 1840. He was succeeded by Frederick William IV. As crown prince a sentimental admirer of English institutions, the new king was expected to grant a constitution to his subjects, but he refused the demand of his states to this effect in 1841. In 1847 he took the cautious step of summoning a combined meeting of provincial parliaments at Berlin, but he conferred on them no real power. When the first shock of the French

revolution was felt it appeared as if Prussian patriotism and loyalty would alone be evoked by it. But it soon became manifest that a wide diversity of interests existed, and that a spirit of alienation and hostility had sprung up between class and class. The country had been increasing rapidly in wealth and prosperity; roads and railways had been constructed, and navigation developed. But the extremes which mercantile prosperity induces had attended its progress. When the dread of French invasion had subsided the crowned heads of Germany, who since 1815 had reigned with a bigoted devotion to the principles of divine right embodied in the Holy Alliance, began to feel their thrones tremble beneath them. The smaller states began to secure themselves by according the reforms demanded by the middle classes. The danger anticipated from France had at the same time awakened a desire for the revival of German unity, and Prussia was looked to to lead in this movement. Delegates from all the minor states waited at Berlin in March to urge the granting of a constitution and the formation of a defensive league with the other states, when the news of the fall of Prince Metternich at Vienna determined the king to yield. But it was too late, insurrection had already begun (18th). It was crowned with success, after a bloody struggle. The king dismissed his ministers, and granted a liberal constitution. The Poles at the same time revolted against Prussia, which had violated her engagement at the Congress of Vienna to govern them as an independent state. They were put down by force at Posen in April and May, 1848. A national assembly met on 22d May, but it proved turbulent and incapable, and its deliberations were influenced by the mobs which continued the work of agitation in the capital. Matters were continually growing worse until on 5th December the king dissolved the assembly in a proclamation granting a constitution, which formed the basis of that which at present exists. A new parliament was assembled, by which its details were elaborated. (See the preceding section—Constitution and Government.) In the meantime two opposite movements for union were agitating Germany. The proletariat contemplated the overthrow of thrones and the formation of a general republic. The conservative unionists wished to re-establish a federal union more or less analogous to the old German Empire. With this last party the purely Germanic character of Prussia had great weight as compared with the composite character of the Austrian Empire, and when a representative assembly of the different states met at Frankfurt it concluded its conferences on the headship of the empire by offering a hereditary crown to the King of Prussia. But the Frankfurt assembly had not succeeded in inspiring respect sufficient to make its offer valid. The alarms which had induced the princes to send their deputies to the assembly in 1848 had begun to subside, and when the German Pharos saw that there was respite they hardened their hearts, dismissed their liberal ministers, and began to govern according to the principles of the Holy Alliance. The King of Prussia declined the proffered crown, and he as well as the Emperor of Austria withdrew their deputies from the assembly. Among the affairs taken cognizance of by the Frankfurt assembly was a revolt of the Duchies of Schleswig and Holstein against Denmark, which was alleged to have violated their constitutional privileges as German states. The King of Prussia intervened in this quarrel at the instance of the Germanic Confederation in 1848-49. After some severe fighting a treaty of peace was concluded on 2d July, 1850, by which the right of Denmark to the duchies was acknowledged, while Holstein was recognized as a member of the Germanic

Bund or Confederation. The duchies revolted against this settlement, and the matter was referred, at the instance of the Emperor Nicholas, to the great powers. By the Treaty of London, 8th May, 1852, to which England, France, Austria, Russia, and Prussia were parties, the Duke of Augustenburg having relinquished, on satisfaction, his claim to the duchies, Prince Christian of Schleswig-Holstein, afterwards Christian IX. of Denmark, was recognized as heir to the Danish crown, the integrity of the Danish monarchy was recognized, but the rights of the Germanic Confederation over Holstein and Lauenburg as members of the Bund were reserved. The breaking up of the assembly at Frankfurt was followed by various intrigues on the part of Prussia and Austria to gain the ascendancy in the Germanic Confederation, which ended in reducing the Bund, which had existed without power since 1815, to its previous state of impotence. (See GERMANY—History.) Prussia remained neutral during the Crimean war, but was one of the signatories of the Treaty of Paris, 30th March, 1856. In 1857 Prussia lost Neuchâtel, which had voluntarily joined the Swiss Confederation in 1848, and was, through the intervention of the great powers (treaty signed at Paris 26th May, 1857), permitted to retain its new allegiance. In the autumn of this year the king was seized with apoplexy, and the government devolved on his brother William, who was named regent in October, 1858. Frederick William died 21st January, 1861, and was succeeded by his brother William. The new king showed a disposition to absolutism, which gave his people considerable uneasiness. In 1862 Prussia, as head of the Zollverein, concluded a liberal commercial treaty with France. In 1862 and 1863 a lengthened dispute occurred between the chambers and the ministry under the direction of Count Bismarck. The king, who took the part of the latter, denied, through his minister, the right of the people to control the financial expenditure through their representatives. On the complaint of the Federal Diet that Denmark had not observed the Treaty of 1852, Austria and Prussia resolved to set that treaty aside, and the Prussians, under General Wrangel, entered Schleswig on 31st January, 1864. The other powers which had been parties to the treaty did not intervene, and Denmark was overpowered. By the Treaty of Vienna, signed Oct. 30, 1864, Denmark gave up Schleswig, Holstein, part of Jutland, and Lauenburg. Differences having arisen between the two powers as to the administration of the conquered provinces, a convention was signed at Gastein, 14th August, 1865. Prussia purchased the claims of Austria over the Duchy of Lauenburg for 2,500,000 Danish dollars, and it was agreed that Schleswig and Holstein should be administered separately by Prussia and Austria respectively, without prejudice to the rights of either party. In a despatch to the British diplomatic agents abroad Earl Russell expressed his regret that all rights, whether old or new, had been trodden under foot, and violence and conquest had been made the only bases on which the dividing powers had established this convention. Differences as to the final disposal of the duchies were not allayed by the convention, but became more irreconcilable. Prussia, which had determined on appropriating them, wished to buy out Austria, but the latter would not cede her claims for money. In support of the policy of appropriation the Prussian lawyers held that the claims of the Duke of Augustenburg had been deferred by the Treaty of 1852 to those of the King of Denmark, and that the latter, in whom the sole sovereignty of the duchies resided, had ceded them by the Treaty of 1864 to the two powers. The claims of Prussia were thus unblushingly rested on conquest. Austria supported

the claim of the Duke of Augustenburg, the son of the duke who had made the cession of 1852; and the Frankfort diet, which had proclaimed the right of the duchies to dispose of themselves, finally decided in favour of Austria. In view of a quarrel, which Count Bismarck had already determined to force upon Austria, a secret treaty had been made with Italy (formally acknowledged 27th March), which by her aggressive preparations had compelled Austria to increase her armaments. This increase was complained of by Prussia, and a circular was addressed (24th March, 1866) to the minor states demanding a decision as to their conduct in the event of Prussia being attacked by Austria. Seventeen of the states seceded from the Bund and sided with Prussia; others referred to the eleventh article of the Act of Federation, which prohibited war between the members of the Bund, and provided for the pacific settlement of their differences. On the 5th of May the Diet of Frankfort summoned Prussia, in accordance with this article, to give a formal declaration that her intentions were peaceful. General Gablenz, the Austrian governor of Holstein, having summoned a meeting of the estates for 11th June, Prussia declared the Convention of Gastein violated. The Prussian troops in Schleswig crossed the frontier on the 8th and dispersed the meeting held on the 11th. The Austrians having evacuated Holstein, General Manteuffel, the Prussian governor of Schleswig, proclaimed the provisional government established in Holstein since September, 1865, abolished, and appointed a president for the administration of the affairs of both duchies. Austria protested and demanded of the diet the mobilization of the Federal army. On the 11th the diet, by a majority of votes, declared that Prussia had broken the treaty, and on the 14th ordered the mobilization of the army. The same day the Prussian representative declared the confederation at an end, and withdrew from the diet. The following day (15th June) the Prussian troops entered Saxony and Hanover. The brief campaign which ensued is known as the Seven Weeks' war. Before entering on it the Emperor of Austria issued a war manifesto to his people, in which he solemnly protested against the unscrupulous ambition of Prussia. The Prussian forces were divided into three main armies; the first, under Prince Frederick Charles, occupied Saxony; the second, under the crown prince, advanced to the frontier of Silesia; and the third, called the army of the Elbe, operated on the right of the first. The whole movements were directed by the chief of the staff, Count von Moltke. The Austrians were commanded by Count Benedek, who distributed his forces along the Saxon and Silesian frontiers of Bohemia and Moravia. The Prussian troops had been recently armed with a new weapon, the needle-gun (*Zündnadelgewehr*). They were better led and commanded than the Austrians, but their decisive success was chiefly due to this deadly weapon. It had been used for the first time in the last Danish war. On 23d June the first Prussian army crossed the Bohemian frontier, and next day occupied Reichenberg. On the 28th a severe struggle took place with the Austrians and Saxons at Münchengrätz, after which the Austrians retired to Gitschin. In the meantime the crown prince was advancing from Silesia through the passes of the Sudetian Mountains. His troops entered the Austrian territory on the 22d at Reinerz and Landschut, from which they advanced to Nachod and Trautenau. After some fighting on the 27th and 28th, in which the Austrians sustained considerable losses, they advanced on the 29th, still fighting, to Skalitz. On the 30th the crown prince effected a junction with Prince Frederick Charles. The third army had also crossed from Saxony into Bohemia, and after an encounter

with the enemy at Hunerwasser, near Turnau, had joined the first army. Gitschin was taken by Prince Frederick Charles on the 29th, and General Benedek fell back on Königgrätz. Here was fought on 3d July the decisive battle of Sadowa, so called from a village near Königgrätz where the chief attack of the Prussians was made. The Austrians, after an obstinate resistance, were completely defeated, the decisive point of the combat being the advance of the crown prince, whose army formed the left wing of the Prussians, on their right, just as they had succeeded in checking the attack of the Prussian right and centre upon this position. In consequence of this reverse the Emperor of Austria ceded Venetia to France with a view to relieve himself of the Italian war, and the Emperor of the French telegraphed to the King of Prussia offering his mediation. Eventually a treaty of peace was signed at Prague on 23d August. The Emperor of Austria agreed to the union of the Lombardo-Venetian Kingdom with the Kingdom of Italy, the debt charged on the Lombardo-Venetian Kingdom by the Treaty of Zurich being taken over by Italy. The emperor recognized the dissolution of the German Bund, and consented to a new formation of Germany in which the imperial state of Austria should take no part. He agreed to recognize a northern confederacy to be established by Prussia north of the Main, and to permit the states south of the Main to form a union, between which and the northern confederacy the terms of agreement were afterwards to be determined. He transferred to the King of Prussia the rights he had acquired in the Duchies of Schleswig and Holstein by the Vienna Treaty of Oct. 30, 1864, with the understanding that the people of North Schleswig, if they expressed their wish by a free vote to be united to Denmark should be ceded to that kingdom. The Emperor of Austria agreed to recognize territorial changes about to be made by the King of Prussia in North Germany, but at his request the King of Prussia agreed to leave the Kingdom of Saxony intact the war contribution of Saxony and its position in the North German Confederation were to be left to the decision of Prussia. After deductions, on account of the share of Schleswig Holstein and the maintenance of the Prussian army of occupation up till the conclusion of the peace, the war contribution of Austria was fixed at 20,000,000 Prussian dollars. All treaties between the parties not invalidated by the dissolution of the Bund were to continue in force, but the coinage and commercial treaties to be revised. A subordinate campaign against Hanover, Bavaria, and other minor states included in the confederation, had been conducted by the Prussians with complete success. After the war Prussia incorporated Hanover, Hesse-Cassel, Nassau, Hesse-Homburg, Schleswig, Holstein, Lauenburg, Hesse-Darmstadt north of the Main, and the principality of Hohenzollern, which already belonged to the royal family. Thus was laid the basis of a strong German state, which, by the natural principle of absorption fostered by hereditary descent, offered the prospect of a solution of German unity by a process exactly the reverse of that to which the division of Germany into independent principalities was due.

On 16th July the King of Prussia invited the States of North Germany to form a new confederation. The terms on which the confederation was to be formed were communicated by Prussia to the different states on 4th August. They were an offensive and defensive alliance; mutual guarantee of integrity of dominions; a federal constitution, with a common parliament; the troops of all the states to be under the supreme command of the King of Prussia; the states to send plenipotentiaries to Berlin to draw up a constitution to be submitted to the

common parliament; the preliminary treaty to be valid for a year, unless superseded by a federal constitution. The treaty was signed by the different states between 18th August and 21st October, the last signature being that of Saxony. It was ultimately joined by the following states—Prussia, Saxony, Mecklenburg-Schwerin, Saxe-Weimar-Eisenach, Oldenburg, Saxe-Meiningen and Hildburghausen, Saxe-Altenburg, Saxe-Coburg-Gotha, Anhalt, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, Waldeck-Pyrmont, Reuss (elder and younger line), Schaumburg-Lippe, Lippe, Lübeck, Bremen, Hamburg, Hesse (for territory north of Main). The North German parliament met on 24th February, 1867. The constitution was formed on the basis of the Prussian proposals, the King of Prussia having, as president of the confederation, the right of representing it in diplomatic relations and of declaring war and peace. The parliament was dissolved by the king in person on 17th April. A reconstitution of the Zollverein was signed 8th July, 1867. The jealousy of France was strongly excited by the success of Prussia in the war and the formation of a powerful confederacy, which threatened to absorb the whole of Germany in an effective union, and the Emperor Napoleon took occasion to object to the Prussian garrison maintained since 1815 in Luxemburg, and entered into negotiations with the King of Holland to purchase that principality. This project was opposed by Prussia, and the relations of the two powers became so strained that war seemed imminent. In these circumstances a conference of the great powers took place in London from 7th to 11th May, 1867. The powers agreed to guarantee the neutrality of Luxemburg, the Prussian garrison was to be withdrawn and the fortress to be dismantled. These measures served to allay the agitation and remove the immediate danger of war.

The Spanish throne having become vacant through the expulsion of Queen Isabella, Prince Leopold of Hohenzollern consented, on the proposal of General Prim, to become a candidate for it. This afforded a new subject of jealousy to France, and after peremptory demands on the part of the French emperor not only that Prince Leopold's candidature should be withdrawn, which was done by himself personally, but that the King of Prussia, as head of the house, should pledge himself not to permit any future candidature of the same kind, war was declared by the Emperor of the French against Prussia on the 15th of July, 1870. The events of the war and the terms of the Peace of Versailles, 26th February, 1871, will be found in our article FRANCO-GERMAN WAR. On the invitation of the North German parliament, supported by the South German states, the King of Prussia assumed at Versailles on 18th January, 1871, the title of German Emperor (See GERMANY.) Prussia has since been the leading state of the new German Empire. After the adoption by the Roman Catholic Church of the doctrine of Papal infallibility a severe conflict, known as the *Kulturkampf* or battle of civilization was carried on by the Prussian government, supported by the majority of the chambers, against the Ultramontane party. In 1872 a School Inspection Bill was passed, intrusting the supervision of all educational institutions, public or private, to the state. In 1873 Dr. Falk, the minister of worship, brought in bills, applying both to the Protestant and Catholic Churches, putting the education of the clergy under strict control of the state, and limiting the right of the superior clergy to dismiss their subordinates. These bills were passed, and they were enforced with great energy. The resistance of the Roman Catholic clergy and the interference of the pope only led to the passing of still stronger measures, but an understanding was at length arrived at. The Emperor William I. died in March, 1888, and was

succeeded by his son Frederick, who lived only for about three months, being in turn succeeded by his son, the Emperor William II. Probably the most notable feature in the internal history of Prussia during recent years has been the extraordinary growth of the Social Democratic Party. The main strength of this party is in the large towns, particularly in the great industrial and commercial centres.

PRUSSIAN BLUE. See BLUE (PRUSSIAN).

PRUSSIC ACID, called also *hydrocyanic* or *cyanhydric acid* (HCN). This acid was discovered by Scheele in 1782, but first prepared in the pure state by Gay-Lussac in 1811. According to Hoefer (*Histoire de Chimie*) it was known to the Egyptian priests, who employed it for poisoning the initiated who had divulged the mysteries. Prussic acid is obtained by distilling with water the kernels of bitter almonds, peaches, apricots, plums, cherries, and quinces; the blossom of peaches, sloes, &c.; the leaves of the beech, cherry, laurel; and various parts of other plants. The acid does not exist ready formed, or only in very small quantity, in these substances, but is produced by a fermentative action (rendered possible by the water) of a substance called emulsin, upon the amygdaline of the plant, which results in the formation of glucose and hydrocyanic acid. Pure prussic acid is prepared by passing a stream of dry sulphuretted hydrogen over dry cyanide of mercury heated in a glass tube, which is connected with a well-cooled receiver. This process is extremely dangerous, as the vapour of the pure acid instantly produces death when inhaled.

An aqueous solution of prussic acid may be prepared by several processes. The following are commonly employed: (1.) Ten parts of ferrocyanide of potassium (yellow prussiate of potash) are heated in a retort with three or four parts of sulphuric acid, diluted with its own volume of water. The retort is provided with a receiver. The liquid which collects in the receiver contains hydrocyanic acid dissolved in water. In this process a constant stream of cold water must continue to circulate through the condensing apparatus; it is also advisable to put a little water into the receiver before beginning the process. (2.) Four parts of cyanide of potassium are placed in a well stoppered bottle, and a solution of 9 parts of tartaric acid in 60 parts of water is added. The bottle is shaken several times, and set aside in a cold place for twelve hours, at the expiry of which time the aqueous solution of hydrocyanic acid, containing about 3·5 per cent., may be poured off from the solid tartrate of potassium.

Pure anhydrous hydrocyanic acid is a colourless liquid, which solidifies at -15°C . to feathery crystals. The specific gravity of the liquid is about 0·7; it boils at 26°C ; it dissolves in all proportions in water, forming a liquid which reddens litmus paper but slightly. The anhydrous acid burns with a very pale violet flame, producing water and carbon dioxide. One drop of the concentrated acid, or the inhalation of the smallest amount of the vapour of the same acid, causes instant death. When diluted largely with air and inhaled the vapour causes an irritation in the throat, giddiness, and headache. Although so very poisonous a substance, hydrocyanic acid is used to a considerable extent in medicine in dilute aqueous solution. The preparation of the pharmacopœia contains about 2 per cent. of true acid. Hydrocyanic acid quickly undergoes decomposition, giving off ammonia, and leaving a brown resinous substance. The aqueous solution likewise slowly decomposes, giving rise to the formation, among other products, of formate of ammonium. This decomposition takes place more quickly the more true acid the solution

contains; it is stopped to a great extent by the presence in the solution of a small quantity of a mineral acid. Alkalies aid the decomposition, exposure to light also quickens this action; hence solutions of this acid which it is required to keep constant should be very dilute, and should be preserved in bottles made of dark glass, kept in closed cupboards. As hydrocyanic acid is such a deadly poison, it is not unfrequently employed for criminal purposes. A ready and accurate method for its detection is therefore very necessary.

The presence of this acid in a liquid may be ascertained by the following tests:—

(1.) A little ferrous sulphate, which has undergone partial oxidation, is added to the suspected liquid, which is then rendered strongly alkaline with caustic soda or potash. If on now adding excess of hydrochloric acid a deep blue precipitate remains undissolved in the liquid, hydrocyanic acid was present in the original liquid.

(2.) A drop or two of the suspected liquid, acidified with a drop of hydrochloric acid, is placed in a small basin, over which is inverted another basin with a drop of yellow sulphide of ammonium on its inner or convex side. The lower basin is very gently warmed for a quarter of an hour or so; the upper basin is now removed, and very cautiously warmed until the yellow colour of the liquid contained in it has disappeared. When this liquid has become quite cold there is added to it one drop of a solution of ferric chloride; if a deep blood-red colour is produced, the original liquid contained the poisonous acid. These tests serve also to detect the presence of a cyanide. Should it be necessary to test the contents of a stomach for hydrocyanic acid, the matter must be mixed with tartaric acid to decidedly acid reaction, placed in a retort connected with a good condensing apparatus and receiver containing a little water, and heat applied. To the liquid which collects in the receiver the foregoing tests may be applied.

The salts produced by the replacement of the hydrogen in hydrocyanic acid by metals are called *cyanides*. Of these many are known. Cyanide of potassium is the most common; it is a white body, which may be produced by the direct combination of its elements; it is very poisonous. If cyanide of mercury be heated to low redness a gas is evolved, which burns with a violet flame. This gas is called *cyanogen*. Cyanogen is a gas at ordinary temperatures, having a pungent odour somewhat resembling that of hydrocyanic acid. It may be condensed to a liquid and frozen to a solid. It combines with many acids, also with the halogens, to form well-defined salts.

A series of salts is known which differs from the cyanides already mentioned in containing oxygen; they are called *cyanates*. *Cyanic acid* (HCNO) may be produced in many ways; thus if a solution of cyanide of potassium be submitted to electrolysis, cyanate of potassium is formed at the positive pole. The acid itself is a thin, colourless liquid, which reddens litmus strongly; it acts very quickly upon the skin, producing painful blisters.

In addition to the cyanides and cyanates there yet remains another series of salts connected with the acid under discussion which merits our attention. These salts are the *ferrocyanides* and the *ferricyanides*. The ferrocyanides have the general formula $\text{M}_4\text{FeC}_6\text{N}_6$, or M_4FeCy_6 —Cy being the symbol often used to designate the compound radical cyanogen. The ferricyanides have the general formula M_3FeCy_6 —in each instance M denotes a monovalent metal.

Ferrocyanide of potassium, the most interesting of the ferrocyanides, has the formula K_4FeCy_6 , and is generally known by the name of *yellow prussiate of potash*. It is prepared by heating together nitro-

genous animal matter, such as hides, hoofs, skin, horns, old leather, &c., with pearl-ashes (carbonate of potassium) and iron-filings, lixiviating the fused mass with water, filtering, and evaporating.

The following table shows the amounts of nitrogen contained in different kinds of animal matter:—

100 parts of horn contain	15 to 17 per cent. of nitrogen.
„ dried blood,	15 to 17 „
„ woollen rags,	10 to 16 „
„ sheep-shearings,	16 to 17 „
„ calves' hair,	15 to 17 „
„ bristles,	9 to 10 „
„ feathers,	17 „
„ hide clippings,	4 to 5 „
„ old shoes,	6 to 7 „
„ charcoal from horn,	2 to 7 „
„ charcoal from rags,	2 to 12 „

From 2 to 5 cwts. of pearl-ashes are melted in a suitable iron vessel, and when heated to bright redness, the animal matter, in the proportion of about 125 parts to every 100 parts of pearl-ash, is added, along with 6 to 8 per cent. of iron in the shape of filings or smithy scales. Combustible gases are evolved in large quantity, and the mass becomes pasty. Heating is continued, the mass in the vessels being stirred until the whole becomes nearly fluid. After one or two hours the semi-fluid substance is ladled out into small cast-iron dishes, where it is allowed to cool. During this process part of the carbon of the animal matter reacts upon the nitrogen to form cyanogen, while another part deoxidizes the pearl-ash, with the production of potassium, which then unites with the cyanogen to form potassium cyanide. The fused mass, or 'metal,' as it is technically called, is now broken into pieces, which are thrown into large iron pans, where they are digested in water as quickly as possible; the aqueous fluid is then run off into evaporating pans, where it is boiled down until it attains a gravity of 1.27, when it is run into crystallizing pans, in which a crude salt is deposited. During this operation the cyanide of potassium and the iron salts in the 'metal' are brought into closer contact, so that they react upon one another, the product of this reaction being ferrocyanide of potassium. It would not be possible for this action to take place at the high temperature of the melting-pots, because at that temperature ferrocyanide of potassium suffers decomposition. The crude salt obtained by the first crystallization is redissolved in water, and the solution run off from any sedimentary matter into cast-iron crystallizing vessels, where large crystals of pure ferrocyanide are gradually formed.

Ferrocyanide of potassium crystallizes with three molecules of water ($\text{K}_4\text{FeCy}_6 + 3\text{H}_2\text{O}$), in large, lemon-yellow, truncated pyramids belonging to the quadratic system. This salt is inodorous; it has a sweetish taste, a neutral reaction, and is not poisonous. By the action of oxidizing agents upon ferrocyanide of potassium one atom of potassium may be removed. A new salt having the formula K_3FeCy_6 , and the name *ferricyanide of potassium*, or *red prussiate of potash*, is thus produced. Ferricyanide of potassium is usually prepared by passing chlorine either over dry powdered ferrocyanide or through a solution of the same salt in water. This salt forms large, blood-red, prismatic crystals, belonging to the monoclinic system. As oxidizing agents convert ferro- into ferricyanide, so, conversely, do reducing agents transform ferri- into ferrocyanide of potassium.

These two salts may be distinguished by their action on iron salts. Ferrocyanide gives a deep blue precipitate with proto-salts of iron, but not with per-salts. Ferricyanide gives a similar precipitate with per-salts only.

PRUTH, a river of Europe, which rises on the eastern side of the Carpathian Mountains, in the

south-east of Galicia; flows circuitously east past Czernowitz, then S.S.A., forming the boundary between Moldavia and the Russian government of Bessarabia, and after a course of more than 500 miles enters the Danube on the left, about 12 miles below Galacz. Its principal affluents are, on the right, the Czeremosz, Elan, and Kagarlui; and on the left the Tchugor, Beghirla, and Lapushna.

PRYNNE, WILLIAM, a learned lawyer and antiquary, was born at Swanswick, in Somersetshire, in 1600, and was placed at Oriel College, Oxford, where he graduated Bachelor of Arts in 1620. He then removed to Lincoln's Inn to study the law, and became barrister, bench, and reader of that society. His attendance upon the lectures of Dr. Preston, a distinguished Puritan, strongly attached him to that sect, and he began to write as early as 1627, attacking the drinking of healths, love-locks, Popery, and Arminianism, which he deemed the enormities of the age. In 1632 he published his work against theatrical exhibitions, entitled *Histrio-Mastix*, which, although licensed by Archbishop Abbot's chaplain, yet, in consequence of some reflections upon female actors that were construed to be levelled at the queen (who had acted in a pastoral after the publication of the work), brought a prosecution upon the author in the Star-chamber, which condemned him to a fine of £5000, to be expelled the University of Oxford and Lincoln's Inn, to be degraded from his profession of the law, to stand twice in the pillory, losing an ear each time, and to remain a prisoner for life. Prynne continued writing against Prelacy in prison, until, for a virulent piece, entitled *News from Ipswich*, he was again sentenced by the Star-chamber in 1637 to a fine of £5000, to lose the remainder of his ears in the pillory, and to be branded in each cheek with the letters S. L. (seditious libeller). This sentence was also executed, and he was removed for imprisonment to Caernarvon Castle, and afterwards to the Island of Jersey. His spirit was not, however, to be subdued, and he continued to write until the meeting of Parliament in 1640, when, being chosen representative for Newport, in Cornwall, the House of Commons issued an order for his release. He entered London, with other sufferers, in triumphant procession, and petitioned the Commons for damages against his prosecutors. On the impeachment of Laud he was employed as chief manager of the prosecution, and when the Parliament became victorious was appointed in 1647 one of the visitors to the University of Oxford, where he laboured strenuously to advance the cause of Presbyterianism. He was also in 1647 appointed recorder of Bath. He warmly opposed the Independents when they acquired ascendancy, and used all his influence to produce an accommodation with the king, being one of the members who were excluded and imprisoned on that account in 1650. With the other excluded members he resumed his seat in 1659, and displayed so much zeal for the Restoration that General Monk was obliged to check his impetuosity. He sat in the Healing Parliament (1660) as member for Bath, and on the Restoration was appointed to the office of chief keeper of the records in the Tower. He occupied his later years in writings connected with his office in the Tower, and finished his life at his chambers in Lincoln's Inn in 1669. Prynne was a man of extensive learning and indefatigable industry, but deficient in judgment. His works, of which Wood has given a catalogue, amount to forty volumes, folio and quarto, the most valuable of which is his *Collection of Records* (three vols. folio).

PRYTANEUM, the town-hall in a Greek state. It was looked on as the official home of the state, and was kept up like a private residence. At Athens foreign ambassadors and citizens returning from embassies

were entertained there. There too the prytanes (those senators who presided in turn) held their meetings, and lived at the public expense during the thirty-five or thirty-six days of their presidency. The liberty of eating in the Prytaneum was one of the highest marks of honour, and was conferred only on those who had done important service to the state.

PRZEMYSL, a town of Austrian Galicia, on the river San, 51 miles west of Lemberg. It has recently been strongly fortified, being a place of strategic importance. It has an active trade and thriving industries. Przemyśl was founded in the eighth century by the Polish prince Przemyślaw, and called after his name. The ruins of the ancient residential castle are on a neighbouring hill. Pop. (1900), 46,295.

PSALMANAZAR, GEORGE, the assumed name of a man of letters, who is chiefly known as a literary impostor. He was born of Catholic parents, in the south of France, in 1679. His mother, being abandoned by her husband, sent her son to a school kept by Franciscan friars; and he was afterwards placed in a college of the Jesuits. He then studied among the Dominicans, and having finished his education acted as a private tutor. Leaving his situation, he engaged in several adventures; and at length having stolen from a church, where it had been dedicated, the habit of a pilgrim, he roved about in that character, subsisting on charity. He afterwards became a common vagrant, and then servant to the keeper of a tavern, whose house he left clandestinely, and, renewing his wandering mode of life, he conceived the project of professing himself to be a Japanese convert to Christianity, who had found his way to Europe. As he did not find this scheme very profitable, he adopted the character of a heathen native of the island of Formosa, and in order to support his pretensions he contrived a new language, which he called the Formosan. At this time he became acquainted with a clergyman named Innes, who, conceiving he could turn the imposture to good account, persuaded the pretended Formosan to suffer himself to be converted to the Church of England; and the clergyman and his new disciple went to London, where the latter was presented to Bishop Compton and others, and the former was rewarded for his zeal with church preferment. Psalmanazar had the effrontery to translate the Church Catechism into his newly-invented Formosan language; and he published a *History of Formosa* (1704), which passed through several editions. In the meantime he was sent to study at Oxford; and a controversy was carried on between his patrons and Dr. Halley, Dr. Mead, and some other less credulous persons, who refused to admit his pretensions. The imposture at length became clearly manifest; and the culprit, deserted by those whom he had deceived, was obliged to rely on the exercise of his literary abilities for his support. He settled in London, where he resided many years, and was employed by the booksellers, particularly about 1730, in the early part of the *Universal History*, published in 1747. Towards the close of his life he drew up an autobiographical Memoir, in which he expresses much contrition for the deceptions which he had allowed himself to practise. His death took place in 1763. Dr. Johnson, who in early life became acquainted with Psalmanazar, always spoke with high respect of his talents and acquirements. Among all the distinguished men he had ever met, he pronounced the impostor Psalmanazar to be the most universally learned and accomplished.

PSALMODY, the art of writing or composing divine hymns or songs. The use of psalmody was common in the early church, by which it appears to have been borrowed from the Jewish synagogue wor-

ship. The composition and performance of psalmody appears to have been practised and encouraged in Germany, France, and the Low Countries before it was introduced into Britain. Most of the old melodies now sung in the service of the parochial churches were set by German musicians. In France psalmody was popularized at the Reformation by Clement Marot and Claude Goudimel, the former of whom translated the Psalms of David in verse, while the latter set them to music. It does not, however, appear that psalm-singing at first gained admission into public worship; but it was a long time confined to family devotion, especially among the reformed. Luther, who was a good musician, is known to have regularly practised psalmody with his friends every evening after supper. The first English version of the Psalms of David, which appeared soon after that of the French, was made in the reign of Henry VIII., by Thomas Sternhold, groom of the robes to that monarch, and John Hopkins, a schoolmaster, assisted by William Whittyngham, an English divine of considerable learning. It was afterwards superseded by the version of Nahum Tate, the poet laureate, and Dr. Nicholas Brady. The early reformers of Scotland paid great attention to psalmody. In John Knox's Psalter the metrical Psalms were arranged for use in churches with four-part harmony. Sternhold and Hopkins' version of the Psalms was first used in Scotland, and was afterwards superseded by the version now in use, founded on that of Francis Rous, provost of Eton, a member of Cromwell's government. Among modern collections of psalmody we may mention that known as Hymns Ancient and Modern, extensively used in the Church of England.

PSALMS, Book or, one of the canonical books of the Old Testament, containing the liturgical collection of hymns used by the Jews in the temple service. The ancient designation of this book is unknown. The present Hebrew name is *tehillim*, praises. The Septuagint version calls it *psalmoi*, from which our name Psalms is derived. Each psalm in the collection, with a few exceptions, has a particular superscription, and in regard to these critics are greatly divided in their opinions and explanations. The titles of the psalms in these superscriptions are various. Many of them are entitled simply prayers. *Maschil*, instruction, *nichtam*, memorial, and numerous other titles are used. The chronology of the Psalms is much disputed. Psalm xc., attributed to Moses, is generally supposed to be the oldest. Probably only a few of the others are older than the time of David, though there is evidence that older collections have been used by the first collectors. Some are as late as the return from the captivity; and some critics assign others to the age of the Maccabees. Hitzig, Lengerke, and Justus Olshausen assign the greater part of the Psalms to the Maccabean period. To this opinion there are insuperable objections. It is evident from history that the Maccabean age, notwithstanding the warlike patriotism displayed in it, was one of rapidly prevailing declension, in which the general spirit of the people was becoming secularized, and the imitation of their gentile neighbours was undermining their attachment to their ancient faith; while those who still clung to it developed a narrow and sterile bigotry, which grew into the endless and meaningless formalities of the Pharisees. It is not to such an age we should look for the noblest and purest aspirations of Hebrew devotion. There is an ancient division of the Psalms into five books, distinguished by the doxologies at the end of Psalms xli., lxxii., lxxxix., cvi., and cxi., which many critics look upon as indicating five distinct collections. Those who take this view place these collections in chronological order as they stand, and some of them con-

sider the particular psalms in each collection as belonging to the period of the particular collection. The first two collections, according to them, contain all the Psalms of David. This view is evidently difficult or impossible to prove; for what is to hinder a later collector from introducing an earlier psalm which had been omitted from a previous collection? The suggestion that the psalms superscribed with the name of David in the later collections were written by descendants of David is more ingenious than plausible. The age of some of the psalms is indicated by allusions, of others by the language employed.

The rhythmical form of the Hebrew poetry is so completely lost that it has been doubted if it had any; but there is a poetical structure in the disposition of the matter more imperishable than mere form, and which even translation cannot destroy. The sentiments are arranged in pairs answering to each other, or each sentiment receives a double expression. This method of composition by strophe and antistrophe is the most universal characteristic of Hebrew poetry. Another characteristic frequently exemplified in the Psalms is the antiphonal structure. There is no doubt that many of the psalms are constructed to be sung in parts. It is evident from the treatment of the subject that in many of them a principal part is assigned to the officiating priest, and a subordinate or responsive one to the people. In others two choirs appear to respond to each other; or some principal personage other than the priest—the king or some successful warrior—takes the leading part. Some may have even a more complex dramatic character; but there is considerable difficulty in determining the extent to which this form of construction prevails in the Psalms, as well as in ascertaining the true form of particular psalms. It is hardly possible to tell how much of the conjectural restoration effected by critics is due to a true insight into the original nature of the composition, and how much is superadded by the plausible ingenuity of the critic. It is evident that almost any lively poem of a descriptive and narrative order would bear partial dramatizing, and the responsive structure of Hebrew poetry is habitual to the writers of poetry of every species, and is not in itself an evidence of a dramatic intention, although this form of composition naturally lends itself to responsive singing or recitation, and may either have originated it or have originated in it.

David, who arranged the temple music, not only appointed from the Levites a number of singers and musicians, but also composed for the divine worship sacred songs, which served as a model for many others. Several of the psalms that bear his name are not, indeed, written by him, but only composed in his manner, and therefore called by his name. Seventy-one, in particular, are ascribed to him, but some of these are evidently of a later date. On the other hand, the contents and style of some which do not bear his name, and the superscriptions of which have perhaps been lost, show him to have been the author. To his times belong most of the psalms attributed to Asaph, Heman, and Ethan or Jeduthun. Twelve psalms bear Asaph's name, of which several show traces of a later origin. Asaph, son of Berechiah, was a Levite, and (1 Chron. xvi. 5) the first of the chief musicians appointed by David for the divine worship. The name of Heman is attached to one only (Psalm lxxxviii.) Heman, surnamed the Ezrahite, seems to have been a Levite, and is named among the chief singers of David. Some of the psalms were composed by Solomon, who, according to the First Book of Kings (iv. 32) wrote a 'thousand and five songs,' but whose name is affixed, in our collection, to two only (Psalms lxxii. and cxxvii.), and of these the first seems rather to have been writ-

ten for Solomon than by him. But, on the other hand, some others, of unknown authors, may be his; several are at least of his time, and refer to events of his reign—the consecration of the temple, &c. The opinion that some psalms are of the time of Samuel, and written by the prophet himself, is supported by no historical testimony, but is not improbable. Most of those by unknown authors seem to be of later date; some few apparently belong to the reigns of the kings immediately succeeding Solomon, several to the mournful days of the Babylonish captivity and of the return, especially those headed 'for the sons of Korah,' most of which are probably by the same author. Of later date also are probably those called 'songs of the degrees,' which some have referred to the return from Babylon, others to the annual pilgrimages to Jerusalem and the temple, and which others suppose to have been sung on the steps of the temple. Our collection consists of 150 psalms, but the manuscripts are not all numbered alike. The Septuagint and Vulgate unite Psalms ix. and x., and div. and cv., while they divide Psalms cxvi. and cxvii. into two, so that their number differs in some respects from that of the English translation.

The Psalms are lyric poems, chiefly odes, and didactic, elegiac or idyllic. (See Lowth's Hebrew Poetry.) Most of them are in the form of prayer, or begin or end with prayer; and, whether they utter complaint, lamentation, or consolation, are expressive of the deepest trust in God. They are among the highest and sublimest efforts of poetry; and the holy light of revelation, the inspiring belief in the eternal true God, spreads over them a bright splendour, and fills them with deep fervour. They must not be compared with the other lyric productions of the ancient world; they are altogether the peculiar growth of the Holy Land, where the voice of revelation resounded most loudly, and was preserved the most purely. Many of their allusions are historical, and must be explained by history; but it would be going too far to attempt to explain everything historically; since it is evident that much is metaphorical, some, though a smaller portion, allegorical, and much prophetic, referring to the future rather than to the past. Some, on account of their local allusions, are less instructive to us; but most of them are rich in encouragement, consolation, filial trust, joyful confidence in God, evidences of humility and patience, and are well adapted for the sacred songs of Christians. It may be added that the collection in the Old Testament by no means contains the whole treasure of Hebrew psalms. Not only are most of Solomon's songs lost, but there are many others mentioned in the Old Testament which are not in our biblical collection.

PSALTER, a collection of the Psalms; also a large chaplet or rosary, consisting of 150 beads, the number of the Psalms in the Psalter.

PSALTERY, or **PSALTERION**, a stringed instrument much used by the ancient Hebrews, and by them called *nebel*. We know but little of the ancient form of this instrument, but have reason to conclude that it resembled that of our harp. The psaltery now in use is a flat instrument, in the form of a trapezium, or a triangle truncated at top. It is strung with thirteen wire cords, tuned in unisons or octaves, and mounted on two bridges. It is played on with a sort of hammer, and thus resembles the modern dulcimer.

PSAMMETICHUS, or **PSAMMITICHUS**, the Greek form of the Egyptian Psametik, a king of Egypt belonging to the seventh century B.C. His father was king of Sais, but was driven from the throne and slain by the Ethiopians, who held Egypt subject for fifty years during the latter part of the eighth

and the beginning of the seventh century B.C. Psammetichus managed to escape to Syria, where he remained till the Ethiopians were expelled. On his return he was made one of the twelve kings who reigned simultaneously in Egypt for fifteen years after the expulsion of the Ethiopian dynasty; but being suspected by the other kings of aiming at sole sovereignty he was driven into banishment, when he took refuge in the marshy districts bordering on the sea. Here he succeeded in obtaining the support of some Ionic and Carian mercenaries, with whose aid he defeated the other kings in a battle fought at Momemphis, on the east side of Lake Mareotis, after which he actually became the sole king of Egypt (671 or 670 B.C.) He fixed his residence at Sais, and is hence mentioned as the founder of the Saitic dynasty. The Greek mercenaries, to whom he owed the throne, were rewarded with settlements on the eastern (Pelusiac) branch of the Nile. By the favour which he thus showed to foreign soldiers he greatly offended the military class in Egypt, a considerable number of whom migrated in consequence to Ethiopia. To protect himself against the enmity of this class he seems to have bound himself all the more closely to the priestly class, whom he gratified by the erection of religious edifices. The most important of these are southern propylæa of the temple of Ptah (identified by the Greeks with Hephaistos) at Memphis, and a splendid aula or court with a portico round it for the habitation of Apis, in front of the temple. He waged wars with Syria and Phoenicia, and took Azotus (Ashdod) after a siege of twenty-nine years. The class of interpreters owed its origin to his sending a number of Egyptian children to learn the Greek language among the Greeks, whom he had settled in the country. He died B.C. 617 or 616.

PSARA, or **IPSARA** (*Peyra*), an island of Turkey, in the Grecian Archipelago, 7 miles north-west of Scio, about 5½ miles in length, and as many in breadth. It consists almost entirely of a rock, thinly covered in some places with a vegetable mould.

PSEUDO, a Greek prefix synonymous with false, spurious, or lying, and often used in this sense as a prefix to other words in most modern languages. Thus we speak of a *pseudo-prophet*, a false or lying prophet; a *pseudo-philosopher*, a false or only would-be philosopher; &c. Sometimes too a work bearing a false name, or any other than that of the author, is said to be *pseudonymous*. In the same sense also we apply the term to individuals who have attempted to personify others by falsely assuming their name, and speak of a *pseudo-Demetrius*, a *pseudo-Sebastian*, or a *pseudo-Isidore*.

PSEUDOMORPH, a mineral which has the form, not of the substance of which it actually consists but of some other substance which has wholly or partly disappeared.

PSKOV, a government of Russia, bounded north by St. Petersburg, north-east by Novgorod, east by Tver, south-east by Smolensk, south by Vitebsk, west by Livonia; area, 16,860 square miles. The surface towards the south-east is rather elevated, being traversed by the Valdai Hills, but sinks gradually down near the centre, having only a gentle slope towards the north and west. Immense numbers of blocks of granite lie scattered in all quarters. The whole government belongs to the basin of the Baltic, the South Dwina, which drains the south-east, carrying its waters into the Gulf of Riga, and the Velikaja, Chelona, and Lovat, with other small tributaries, carrying the rest of the drainage into the Gulf of Finland. The soil is throughout of poor quality, and can only be made to yield tolerable crops by heavy manuring. Wheat is seldom grown, and the prin-

cipal crops are oats and barley, which are raised in considerable quantities, so as to leave a surplus for export. A considerable extent of ground is sown with hemp and flax. Forests also are extensive; but the wood is not of the best quality, and oak is seldom met with. Pine is very prevalent, and furnishes the means of manufacturing large quantities of pitch. The only other manufacture of importance is leather. Pskov is divided into eight districts. Pop. (1897), 1,186,540.

PSKOV, or PLESKOV, a town, Russia, capital of the above government, on the right bank of the Velikaia, which here receives the Pleskova, 165 miles s.s.w. of St. Petersburg. It is walled, flanked with towers, all in a very dilapidated state, as are also many of the houses. It consists of the Kremlin, the Central city, the Great city, and a considerable suburb. All the private houses and the far greater part of the public edifices are of wood. The finest buildings are in the Kremlin. Among others are the cathedral, of very little architectural merit, but gorgeously decorated; and the palace of the ancient princes of Pskov, now occupied by the archbishop. The number of churches amounts to thirty, but more than a third of them are in disuse. The principal manufacture is Russian leather; and there is a considerable trade in hemp, flax, tallow, hides, &c., with Narva and other seaports on the Gulf of Finland. Pskov is the see of an archbishop, and possesses a theological seminary, a Bible society, and a well-managed hospital. It is said to have been founded by the Princess Olga towards the end of the tenth century. Pop. (1897), 30,424.

PSORIASIS. See ITCH.

PSOROSPERMIAE. See PROTOZOA.

PSYCHE (Greek, the soul), a lovely maiden, celebrated on account of the beautiful story respecting her, in which she is to be considered an allegorical personification of the human soul. Apuleius makes her the daughter of a king, and relates her history thus: Psyche, whose two elder sisters were of moderate beauty, was so lovely that she was taken for Venus herself, and men dared only to adore her as a goddess, not to love her. This excited the jealousy of Venus, who, to revenge herself, ordered Cupid to inspire her with love for some contemptible wretch. But Cupid fell in love with her himself. Meanwhile her father, desiring to see his daughter married, consulted the oracle of Apollo, which commanded that Psyche should be conveyed with funeral rites to the summit of a mountain, and there be left, for she was destined to be the bride of a destructive monster in the form of a dragon, feared by gods and men. With sorrow was the oracle obeyed, and Psyche was left alone on the desert rock, when suddenly Zephyr hovers around her, gently raises and transports her to a beautiful palace of the god of love, who visits her every night unseen and unknown, leaving her again at the approach of day. Perfect happiness would have been the lot of Psyche, if, obedient to the warning of her lover, she had never been curious to know him better. But by the artifices of her jealous sisters, whom she had admitted to visit her contrary to the commands of Cupid, she was persuaded that she held a monster in her arms, and curiosity triumphed. As he slept she entered with a lamp to examine him, and discovered the most beautiful of the gods; in her joy and astonishment she let a drop of the heated oil fall upon his shoulders. Cupid awoke, and having reproached the astonished Psyche for her suspicions fled. After having tried in vain to throw herself into a river, she wandered inconsolable to all the temples, seeking everywhere her beloved, till she came to the temple of Venus. Here began her severest sufferings. Venus kept her

near her person, treated her as a slave, and imposed upon her the severest and most trying tasks. Psyche would have sunk under the burden had not Cupid, who still tenderly loved her, secretly assisted her in her labours. But in the last dangerous task imposed upon her, to descend to the realm of shadows, and bring away Proserpine's box of cosmetics, she almost perished. She succeeded indeed in the adventure; but having opened the box a deadly vapour issued from it, and she sunk lifeless to the earth. Cupid now appeared, and the touch of his arrow restored her to life. Venus was finally reconciled; by Jupiter's command Psyche became immortal, and was for ever united with her beloved. Her marriage was celebrated with great festivities, and her envious sisters threw themselves from a precipice. Raphael has given a most beautiful representation of the marriage in the Farnesina at Rome.

PSYCHOLOGY (Greek, *psuche* or *psyche*, the soul, and *logos*, word, doctrine), that department of philosophy which has specially to do with the observation of the states and actions of the human mind. The division of philosophy into various branches is at once natural and convenient, but it is to be regretted that philosophers themselves do not always attend to the nature of the distinction on which such a division depends. There can be no absolute line drawn in philosophy between observation and reasoning. There cannot be one department of philosophy from which observation is excluded, and another from which reasoning is excluded. When we first enter on philosophical inquiry we are already in possession of a body of facts bearing on the subject of our investigation; but when we begin to reason in these facts we find them insufficient and unsatisfactory, because they have been collected without method or design. We have, therefore, to begin again to recollect our facts by a methodical process of inquiry specially directed to the solution of the questions which have suggested themselves to us in our preliminary reasoning, and as new questions arise in the course of our investigation new processes of inquiry have to be set on foot with a view to their elucidation. It is to this methodical process of investigating facts that the term psychology properly applies. There are stages of philosophical investigation in which we may engage in lengthened processes of reasoning and induction from facts already ascertained or assumed. These processes are commonly called metaphysical or ontological; but as the metaphysical processes are founded on observation, so the methodical processes of investigation implied in psychology are directed by reasoning, and as the observation of facts tends to the discovery of laws, which is itself a species of observation, psychology not only demands method but admits induction. The distinction between it and other more abstruse branches of philosophy is, therefore, one not of kind but of degree. Those philosophical processes which are mainly directed to observation, and immediate induction from observation, comprehending the distinction and classification of the various series of observed facts, that is, of mental states, processes, and powers, are properly called psychological; those processes which carry out to their completion the lines of reasoning already begun upon assumed facts, and which, by subjecting the facts to a more searching analysis, aim at acquiring a more exhaustive knowledge of them, and drawing from them more extended inferences, are properly called metaphysical or ontological. These processes, it is evident, mutually react upon each other, and the psychological process cannot be held to be complete till it has received the final revision of the metaphysical. Thus, Plato describes the method of philosophical investigation, which he calls

dialectical, as the process of ascending from particulars to generals, and of redescending from the general to the particular.

The complete method of philosophy is, however, subject to this drawback that the subject is inexhaustible, and that the reasonings to which philosophical facts give rise are endless. Hence the convenience of divisions and breaks in the processes of reasoning, that conclusions may be revised and facts reverified; but the nature of these divisions must be clearly understood, or they will inevitably promote error and confusion.

During the reign of the scholastic philosophy reasoning and distinction were carried to such an extent, and drawn out with such a multiplicity of subtleties and refinements, that the facts were overburdened, distorted, misrepresented, lost sight of, and contradicted till the very meaning of words became doubtful. In these circumstances Descartes recalled the attention of bewildered thinkers to the process of observation and re-established psychology. At present a somewhat different danger appears to attend philosophy, and its psychological groundwork, after being built over and buried, is now being undermined, and threatened with being swept away as an obstruction to a profounder science.

This danger proceeds from a school which, through some at least of its exponents, arrogates to itself exclusively the title of psychological, and repudiates, as a thing entirely apart from psychology, all connection with metaphysics. We have shown that even as a branch of philosophy psychology cannot be supposed altogether to exclude induction. Much more if psychology is erected into an independent science must induction be included in it. The definition of psychology then must be the observation of and induction from mental phenomena. What is this but a definition of philosophy? and what in this case is the meaning of the repudiation of metaphysics? It certainly does not mean that these psychologists wish to limit the range of induction from facts. This is an interpretation which they would by no means admit, and which, in fact, their own procedure shows that they do not acknowledge. There seems only one other admissible interpretation, that by metaphysics they mean induction which they do not like, and by psychology induction which they do like. It would be very rash to deny that much false induction has gone under the name of metaphysics, but it does not seem a very promising mode of escaping false induction to change the name of the process.

But the inconvenience of putting their metaphysics under the title of psychology, and thus destroying the distinction which the introduction of psychology as a branch of philosophy was intended to establish, is not the only charge against this school. It seems in danger by the undue prominence it gives to a particular class of questions of destroying another well understood distinction, that between physiology and psychology. The physico-psychological problem, to which the chief attention of this school is directed, belongs in its complete treatment neither to psychology nor to physiology, but to philosophy, which receives and combines the results of the several sciences, and the physiological part of this problem does not belong to psychology at all. That physiological and psychological phenomena are blended in fact, and that consequently no absolute dividing line can be drawn between them is true; but the reason of forming two sciences is that the phenomena as far as distinguishable may be studied apart. If, instead of occupying himself with what is clearly distinguishable in his own department, the psychologist bestows his whole attention upon the dividing line, he obviously neglects his duty. It may be indeed, and per-

haps is contended, that there is no distinction at all. But this contention can only be established by fact. As far as the physiologist advances his line the psychologist must recede. There is, however, at present a clear domain into which physiology cannot advance, and any apparent advance of physiology, or even of physico-psychology, into this domain is merely illusory. Physiology can only tell us of things which accompany mental states or processes, or the exhibition of mental powers; it can tell us nothing about these states, processes, or powers themselves. This is the domain of psychology, and into it there is no prospect of physiology ever penetrating. The existence of a nerve may explain the transmission of sensation, the course of the nerve the direction of transmission, the motion of the nerve the speed of transmission, but neither nerve nor brain explains the fact of sensation. Suppose we learn that memory is always attended with a process of physical action, or with a permanent modification of some particular structure of the brain, how does this help us to explain the phenomenon of memory? or if we learn that the acquired habits of an animal effect physical modifications which are transmitted to succeeding generations, and become in them the bases or exciting cause of instincts, how does this enable us to understand instinct as a fact of consciousness? In these cases we only learn that the phenomena of consciousness are attended with certain circumstances, the connection of which with these phenomena is to us mysterious and inexplicable.

When then we observe phenomena which are beyond the range of physical explanation, when we call these phenomena mental, and ascribe them to an agent called mind, we do not necessarily ignore the association between mental and physical phenomena, but we establish a science of the former which reaches beyond, and is in its own sphere independent of the latter; that science, which, like physiology, is only a branch of the universal science, philosophy, is psychology.

PTAIRMIGAN. See Grouse.

PTERICHTHYS ('winged-fish'), a genus of extinct fishes belonging to the order Ganoidae, and included in the sub-order Ostracosteidae of that division. This genus was first discovered in the Old Red Sandstone formations by the late Hugh Miller in 1833. The head and front half of the body were covered by large ganoid plates, these plates consisting of bone coated with harder enamel. The plates of the trunk formed a buckler-like shield, or back-plate and a breast-plate, these plates being articulated together at the sides or margins of the body. The several plates investing the body were joined by suture. The hinder part of the body and tail were covered by ganoid plates of smaller size, and these regions of the body may therefore have been endowed with a great degree of flexibility. A small and single dorsal or back fin existed, the tail-fin being unequally-lobed or heterocercal. A pair of ventrals and a pair of pectoral fins were also represented. The pectoral fins were peculiarly developed, their conformation giving rise to the scientific name of the genus. They consisted each of a strong spinous process composed of two segments, and covered by tubercular or small ganoid scales. In general form these fins are somewhat wing-like, and from their mode of attachment to the body must have been capable of a certain range of motion; but their chief office was probably that of aiding these fishes to shuffle along 'the sandy bottom or bed if left dry at low-water' (Owen). Locomotion was chiefly subserved by the caudal and dorsal fins. The armour-plating of the head seems to have been articulated by means of a movable joint to the trunk-buckler, this mode of articulation being

seen in the existing *Lepidosteus* or Bony Pike of the North American lakes.

These fishes are absolutely confined to the Devonian or Old Red Sandstone rocks, and are found in greatest abundance in these formations in the north of Scotland. The most familiar species is the *Pterichthys Milleri*—named after the discoverer of the genus, who wrote of his discovery as having laid bare 'one of the most extraordinary' organisms of the Devonian system, and 'one in which Lamarck would have most delighted.' Other species are the *P. cornutus*, *P. latus*, *P. major*, &c., these several species being distinguished and recognized by the proportions of the bucklers, of the pectoral fins, and of the tail. The jaws in all are of small size, and possess confluent denticles or rudimentary teeth.

PTERODACTYL ('winged-finger'), a remarkable genus of extinct Reptilia, forming the typical example of the fossil order Pterosauria. These forms were distinguished chiefly by the enormous elongation of the fifth or outermost finger, which served for the attachment of a *patagium* (which see) or flying-membrane, by means of which these forms could support themselves in the air, much after the fashion of our existing bats. No outer skeleton of scales, &c., seems to have been developed. The dorsal vertebrae are procelous, or hollow in front and convex behind, the front ribs of the trunk possessing double heads. The cervical or neck vertebrae were of large size, those of the pelvis being exceedingly small. The breast-bone was broad, and, as in birds, bore a median ridge or keel for the attachment of the pectoral or breast muscles, which are used in flight. The sternal ribs were ossified. The jaws were elongated, and provided with teeth, set in *alveoli* or sockets. The head itself was of relatively large size. The eye was protected and strengthened by possessing a row of bony plates in its outer or sclerotic coat. The bones of the shoulder-girdle consisted of a shoulder-blade or scapula, and of large coracoid bones, which, as in birds, were attached directly to the breast-bone. No collar-bones or clavicles appear to have been developed. The bones of the fore-arm were elongated, the outermost finger, as already mentioned, being excessively developed in this respect, and clawless, whilst the other digits were furnished with claw-like nails. The number of phalanges (which see) in the fingers is progressive from the first to the fourth, this being a markedly reptilian character. The elongated finger gave support to a wing-membrane, which extended along the sides of the body to the comparatively small and weak hind limbs, and may have also stretched between the hind limbs and short tail. The bones were *pneumatic*, as in birds, that is, were hollow, and were filled with air instead of containing marrow; a disposition of structure adapted to render the body light for flying. That these reptiles possessed powers of flight analogous to existing bats seems most probable; the *patagium* of the bats differing from that of the Pterodactyls in being supported by four elongated fingers and not by one digit only. It is also to be borne in mind that the Pterodactyls were true reptiles and not allied in any intimate structural points to the bats. The Pterodactyls may also have been able to swim as well as to fly. The only living reptile which can support itself in the air is the flying lizard (*Draco volans*) of the Eastern Archipelago; and even this form cannot fly in the true sense of the word, but merely supports itself by its *patagium* in its aerial leaps from tree to tree.

The Pterodactyls are exclusively confined to the Mesozoic rocks, being found from the Lower Lias to the Middle Cretaceous rocks inclusive. The lithographic slates of Solenhofen in Bavaria, belonging to the Upper Oolitic system, are especially rich in

Pterodactyl remains. Most of them are of small or moderate size; one specimen, however, from the Cretaceous rocks, must have measured more than 20 feet in expanse of wing from tip to tip. Familiar species, amongst many, are the *P. crassirostris*, *P. longirostris*, *P. longicollis*, *P. brevirostris*, *P. medius*, &c. (See also PTEROSAURIA. See illustration at GEOLOGY.)

PTEROMYS. See SQUIRREL.

PTEROPIDÆ, PTEROPUS. See KALONG BAT.

PTEROPODA. See MOLLUSCA.

PTEROSAURIA, an extinct order of reptiles, represented by the Pterodactyls (which see), and by the genera *Ramphorhynchus* and *Dimorphodon*. This group, as mentioned in the article **PTERODACTYL**, is especially noted as containing forms which possessed the power of flight, the outermost digit or finger of the hand being greatly elongated so as to support a *patagium* (which see) or flying membrane. Mr. Seeley places the Pterosauria in a special class (that of the Ornithosauria) owing to their modifications for flight rendering them different from other groups of extinct reptiles. The Pterosauria are confined to the Mesozoic rocks. *Dimorphodon* possesses large, sharp, front teeth, and small, lancet-shaped hinder teeth. *Ramphorhynchus* has no teeth in the front portion of either jaw, but possesses hinder teeth in both jaws. The front portion of the jaws in the latter form may therefore have formed a bird-like beak. In Pterodactylus the jaws are fully provided with teeth, all of which are of elongated and slender shape. *Dimorphodon* is represented by the *D. macronyx* from the Lower Lias of Dorset. Species of this form show a skull of 8 inches in length and an expanse of wing of about 4 feet. The tail was probably short, whilst in *Ramphorhynchus* it was long, stiff, and slender. *Ramphorhynchus longicaudus*, *R. Gemmingsi*, and *R. Münsteri*, all from the lithographic slates of Solenhofen (Upper Oolites), represent species of this genus.

PTOLEMAIC SYSTEM, the system of astronomy by which Claudius Ptolemy tried to explain celestial motions. The earth is the fixed centre of the universe; a vast sphere, the 'primum mobile,' carries all the celestial bodies, and rotates once a day; the sun and moon travel in eccentric circles round the earth, and this accounts for the annual motion of the sun, and the monthly motion of the moon; each planet moves in a circular path, termed its epicycle, about a point, and this point travels in an eccentric circle round the sun; all motions in each order of circle being described uniformly, this explained the looped paths, the progressions, stations, and retrogradations of the planets. Every new astronomical observation required a new contrivance on this system, and at length the necessary cyclic and epicyclic combinations became excessively cumbrous. Copernicus taught that the daily motions of the sun and stars are only apparent, and that the earth turns on its axis.

PTOLEMAIS. See ACRE.

PTOLEMY (PTOLEMAIOS), the name of a line of Græco-Egyptian kings, who succeeded, on the division of the empire of Alexander the Great, to the portion of his dominions of which Egypt was the head. The name Ptolemy, though the common, was not the exclusive name of the kings of this dynasty, and they are better distinguished by the surname Lagidæ, from Ptolemæus Lagus, the founder of the dynasty, also surnamed Soter.

PTOLEMY I., called *Soter*, the Saviour, was by birth a Macedonian. His mother was Arinœ, the mistress of Philip. His father is commonly reputed to have been Lagus, a Macedonian of humble birth; but the distinction with which Ptolemy was received at court has led some to attribute to him a higher origi-

According to Lucian he was born about B.C. 367, but on the supposition of his being a son of Philip it must have been some years later. Ptolemy was one of the intimate friends of Alexander, and was banished by Philip for the part he took in the intrigue for the marriage of the prince with the daughter of Pixodorus. He was recalled on the accession of Alexander. He attended the king on his expedition to Asia, but does not appear at first to have held any important command. In B.C. 330 he was admitted into the body-guard, and from this time he begins to appear in important transactions. In 329 he was sent with a detachment to apprehend Bessus, and in the reduction of Sogdiana he commanded one of the chief divisions of the army. During the Indian campaigns he was regularly employed in the most important commands, and distinguished himself alike for valour and capacity as a general. He continued on terms of intimate friendship with Alexander, and at the festivities of Susa he was honoured with a crown of gold, and obtained in marriage Artacama, sister of Barsinê. He accompanied Alexander in his last campaign in B.C. 324. On the death of Alexander he attached himself to the party of Perdiccas, and secured for himself the government of Egypt. One of his first acts on assuming the government was to put to death Cleomenes, the receiver-general of tributes, who had administered the province under Alexander, and had amassed vast treasures by arbitrary means. This measure was acceptable to the Egyptians, and tended to establish the independence of Ptolemy. He then proceeded to strengthen himself in his government, and concluded a secret league with Antipater against Perdiccas. In B.C. 322 he annexed Cyrene to his dominions. When war broke out in B.C. 321 Perdiccas himself marched against Ptolemy. He reached Pelusium with a numerous army, but was repulsed in his early attempts to force the positions of Ptolemy, and perished in a revolt of his own soldiers. In the arrangements made after the death of Perdiccas Ptolemy retained Egypt; he subsequently strengthened himself by a matrimonial union with Eurydice, daughter of Antipater. In the following year (B.C. 320) he seized the satrapy of Phœnicia and Coele-Syria, which had been assigned to Laomedon. On the death of Antipater (B.C. 319) Ptolemy united with Cassander and Antigonus against Eumenes, and on the defeat of Eumenes by Antigonus he joined Cassander and Lysimachus against the latter. Antigonus invaded Syria in 315, overran Phœnicia, and laid siege to Tyre, which he took in 314. Ptolemy, who was master of the sea at the same time, occupied Cyprus, and attempted to gain over the Greek cities. Cyprus revolted in 313, and Ptolemy proceeded thither in person, and reduced the whole island. In 312 he invaded Palestine, and with Seleucus defeated Demetrius, son of Antigonus, at Gaza; but when Antigonus advanced into Syria to the relief of his son he retired into Egypt. In B.C. 311 a general peace was effected, but it was not of long duration. It was broken by Ptolemy in 310. On the plea that Antigonus had not withdrawn his garrisons from Asia Minor he sent a fleet to Cilicia, which reduced some of the cities on the coast, but withdrew on the approach of Demetrius. In B.C. 309 Ptolemy invaded Lycia, and took several cities, but Demetrius having come to the relief of Halicarnassus, which he was besieging, he withdrew to Myndus. In 308 he invaded Greece, and proclaimed himself as a liberator; but he made little progress, and having garrisoned Corinth and Sicyon, which he lost some years later, he returned to Egypt. His brother at the same time recovered Cyrene, which had thrown off the yoke of Ptolemy. Antigonus now resolved to wrest Cyprus from

Ptolemy (B.C. 307), who advanced to its relief with a powerful fleet. The Egyptians were totally defeated at Salamis, and Cyprus fell into the hands of the victor, who assumed the title of king. This example was followed by Ptolemy B.C. 306. Antigonus now advanced against Egypt through Syria with a powerful army, supported by a fleet under the command of Demetrius. Ptolemy fortified the passages of the Nile, which Antigonus was unable to force, and was compelled to retire. Next year Ptolemy contented himself with assisting the Rhodians against Demetrius. It was from the Rhodians on this occasion that he acquired his surname of Soter. In 302 a league was formed against Antigonus, including Seleucus, Lysimachus, and Cassander, along with Ptolemy. Ptolemy did not take a very active part in the league; he advanced into Coele-Syria, but being alarmed by a false report that Antigonus had won the battle of Ipsus he retired to Egypt. The defeat and death of Antigonus in this battle raised Seleucus to a position of great power, and a dispute ensued between him and Ptolemy for the possession of Coele-Syria and Phœnicia, which were ultimately acquired by Seleucus. Ptolemy now entered into alliance with Lysimachus and Demetrius. He received at his court Pyrrhus of Epirus, gave him his step-daughter Antigone in marriage, and assisted him in recovering his throne. In 295 Ptolemy recovered Cyprus, which became a permanent dependency of Egypt. In 287 he joined in a league with Lysimachus and Seleucus against Demetrius, who, after losing all his possessions in Asia, had become king of Macedonia, and was making great preparations for an eastern expedition. Ptolemy assisted the allies with a fleet, and the war against Demetrius was successful. Ptolemy had two sons by Eurydice, but he determined to bestow the crown on Ptolemy Philadelphus, a younger son by his favourite wife Berenice. He announced his own retirement, and caused him to be proclaimed as his successor, in B.C. 285. He died two years after, B.C. 283. Ptolemy is regarded as the most prudent of the successors of Alexander. His internal administration of Egypt was enlightened and successful. He raised Alexandria to the highest rank in commercial prosperity. He founded in that city a colony of Jews, to whom the special place taken by Alexandria in subsequent times in philosophy and literature, as well as in politics, was in great measure due. He was also an eminent patron of literature, science, and art, and founded the library and museum of Alexandria. He himself wrote a narrative of the wars of Alexander, which is used as an authority by Arrian.

PTOLEMY II. (*Philadelphus*) was born in Cos, B.C. 309. His tutors were Philetus of Cos and Zenodotus, from whom he received a careful education. He was raised to the throne, as already mentioned, during the lifetime of his father. His reign was generally peaceful. His half-brother Magas, who governed Cyrene, made himself independent on the death of his father, invaded Egypt, and made alliance with Antiochus II., king of Syria. Ptolemy at length acknowledged his independence, and betrothed to him the infant daughter of his son Ptolemy. Cyrene was subsequently reunited with the monarchy by the marriage of his son Ptolemy with Berenice, daughter of Magas. Ptolemy sent a fleet to assist the Athenians against Antigonus Gonatas. He concluded a treaty with Rome after the defeat of Pyrrhus, and continued faithful to his alliance during the Carthaginian war. There was a chronic but uneventful war carried on during his reign with Syria. Towards the close of his reign it was terminated by the marriage of Ptolemy's daughter Berenice to Antiochus III. Either by the treaty

or in the course of the war Ptolemy acquired Coele-Syria and Phœnicia. He was also, in general, on hostile terms with Macedonia. But the chief care of Ptolemy was directed to the internal administration of his kingdom and the encouragement of commerce. He carried his arms into Ethiopia, and founded the fortress of Ptolemais to protect the trade in elephants, which were brought from these regions to Egypt for warlike purposes. He founded Arsinoë (on the site of Suez) to protect the navigation of the Red Sea, and Berenice, on the Red Sea coast, under the Peninsula of Lepte (Ras Benasse); from the latter place he formed a road to Coptos on the Nile, by which the caravans and the commerce of India and Arabia continued for ages to pass to Alexandria. The chief glory of Philadelphus was his munificence as a patron of science and literature. He raised the institutions founded by his father to the highest degree of splendour. He spared no pains to fill the library of Alexandria with all the treasures of ancient literature. Like his father he associated on familiar terms with the learned men who frequented his court. Among the architectural works of merit erected during his reign were the lighthouse on the island of Pharos, the Alexandrian Museum, and the royal burying-place, to which he removed the remains of Alexander and those of his father. He founded numerous cities and colonies not only in Egypt, but in Syria and Cilicia. It is no disparagement to say that the schemes of Ptolemy were mainly calculated to promote the prosperity of his Greek subjects, seeing the Egyptians were not oppressed, and Greek civilization was the highest known to him. He is supposed to have been the patron of Manetho in his Greek rendering of Egyptian history, and there is a tradition that it was at his instance that the Seventy made their translation of the Old Testament. During his reign the dominion of Egypt extended into Ethiopia, Arabia, and Libya, and embraced the provinces of Phœnicia and Coele-Syria, besides extensive tracts in Asia Minor and the islands of the Mediterranean. In his private life there were many excesses. He put to death some of his near relatives, and he violated the religious principles of the Greeks in relation to marriage by marrying his sister Arsinoë, the widow of Lysimachus, and his senior. It was in relation to her he assumed the surname of Philadelphus. He called many of his cities after her, erected a temple to her memory, and caused divine honours to be paid to her. Ptolemy died in 247. He was succeeded by Ptolemy III., his son by his first wife Arsinoë, daughter of Lysimachus.

PTOLEMY III., surnamed *Euergetes*, was early engaged in an important war. Antiochus III. of Syria had put away his wife Laodice to marry Berenice, daughter of Ptolemy II. On the death of Philadelphus he put away Berenice and restored Laodice. The resentment of Laodice, however, was not appeased, and she sacrificed to her revenge her husband, her rival, and their infant son. Ptolemy took up arms too late to save his sister, but with a view to avenge her he invaded Syria, and advanced without opposition to Antioch, when he turned his arms eastward, subdued Mesopotamia, Babylon, and Susiana, and advanced to the confines of India. He was recalled to Egypt by intelligence of seditions having broken out in his absence, and he brought with him the statues of Egyptian gods which had been carried off by Cambyses, which he restored to their respective temples, and thus earned the title of *Euergetes* (benefactor) from his subjects. The fleets of Ptolemy had at the same time subdued the coasts of Asia Minor, and carried his arms to the Hellespont and to the coast of Thrace. After Ptolemy's return to Egypt, the date of which is uncertain,

Seleucus, son of Antiochus, recovered a considerable portion of his father's dominions, especially of the eastern provinces, while the maritime regions and part of Syria remained in the possession of Ptolemy. Ptolemy made use of Antiochus Hierax, the younger brother of Seleucus, to promote division in Syria, supporting him in wars against his brother, and thus preventing Seleucus from extending his conquests. Antiochus was at length totally defeated, and compelled to take refuge in Egypt. Ptolemy took some part in the affairs of Greece generally, as was the policy of Egypt, against the rulers of Macedonia. He maintained friendly relations with Rome, but declined the assistance of the Romans in his war with Syria. In the latter part of his reign he made war with the Ethiopians, and extended his dominion in the south of Egypt. Ptolemy continued the patronage of literature, and added largely to the library of Alexandria. Like his predecessors he was the patron of scholars, and his court was the resort of the most distinguished men of his day. In his reign the Græco-Egyptian kingdom attained its highest prosperity at home, and its widest dominion abroad. He exhibited also more than his predecessors of the feeling of a native Egyptian king, and by his recovery of their sacred treasures recalled to his subjects the glories of their ancient history. He also repaired and enlarged the Egyptian temples, and dedicated new shrines to the national gods. He died in B.C. 222.

PTOLEMY IV., surnamed *Philopator*, was suspected, though probably without ground, of poisoning his father, whom he succeeded, and the beginning of his reign was marked by atrocious crimes. He put to death his mother Berenice, his brother Magas, and his uncle Lysimachus, and, giving himself up to indolence and sensual gratification, abandoned the cares of state to his minister Sosibius, his adviser in these and other crimes. With this vicious reign began the decline of the kingdom. Roused from his lethargy by the loss of his Syrian possessions, which had been gradually wrested from him by Antiochus the Great, Ptolemy put himself at the head of a large army and completely defeated Antiochus at Raphia, in B.C. 217. By this victory he recovered Coele-Syria, but being too indolent to pursue his success he speedily made peace and returned to his pleasures. On his return he began to persecute the Jews of Alexandria, having, it is said, been offended at the refusal of the high-priest to admit him to the sanctuary in the temple of Jerusalem. A revolt of the native Egyptians at the same period led to a protracted struggle, and caused much bloodshed. Ptolemy married his sister Arsinoë, and near the close of his reign, with the assistance of Sosibius, put her to death. He then gave himself up more completely to debauchery, which probably shortened his career, and died B.C. 205. Philopator continued in general the policy of his ancestors. He patronized literature, and dedicated a temple to Homer as a divinity. During the Carthaginian war he supplied the Romans with corn. He prided himself in building galleys of unusual size, one of which is said to have had forty banks of oars.

PTOLEMY V. (surnamed *Epiphanes*), the son and successor of Ptolemy IV., was under five years old at his father's death. Agathocles, brother of the late king's mistress, assumed the reins of government, and kept the death of the king secret in order to assure his power. He and his sister, with their supporters, were, however, put to death in a popular insurrection, when Sosibius, the son of the late minister, attempted to make himself master of the king's person and of the government; but had to give place to Tlepolemus, a popular soldier, who had little

administrative capacity. In these circumstances Philip of Macedon and Antiochus III. (the Great) of Syria combined to dispossess Ptolemy, and divide his dominions. Philip began to reduce the Cyclades and the cities of Thracæ which belonged to Egypt, while Antiochus invaded Cœle-Syria. Instead of relying on the internal resources of the kingdom to repel this danger, the guardians of the young king took the fatal step of placing him under the protection of Rome. The charge was gladly accepted by that powerful and crafty state, and Philip and Antiochus were commanded to restore their conquests. Antiochus had already wrested from Ptolemy nearly all his Syrian possessions, as well as the cities held by the Egyptian kings in Lycia and Cilicia. To avoid embroiling himself with the Romans, he agreed, B.C. 199, to give Ptolemy his daughter Cleopatra in marriage, with the Syrian provinces as her dowry. The marriage took place in B.C. 193-192, and in the interval of peace Egypt began to recover prosperity under the administration of Aristomenes. Several revolts, however, took place, and in B.C. 196 it was determined to declare Ptolemy of age. During the war between Antiochus and the Romans Ptolemy continued in strict alliance with the latter, but at the conclusion of the war Antiochus still held possession of Cœle-Syria and Phœnicia. After the death of Aristomenes the government of Egypt was chiefly conducted by Polycrates, who encouraged the king to give himself up to debauchery. Ptolemy was cut off by poison, while he was preparing to recover Cœle-Syria from Seleucus, the successor of Antiochus, B.C. 181. Nearly all the foreign possessions of Egypt were permanently lost during the unfortunate minority of this reign.

PTOLEMY VI. (surnamed *Philometor*) was also a child at the death of his father. His mother Cleopatra, who assumed the regency, maintained peace and preserved internal tranquillity by an able administration; but the ministers who succeeded after her death (B.C. 173) provoked a war with Antiochus Epiphanes, and were totally defeated near Pelusium. Antiochus advanced to Memphis and took Ptolemy prisoner (B.C. 170). Upon this incident the brother of Ptolemy caused himself to be proclaimed king at Alexandria, under the title of Ptolemy Euergetes II. Antiochus besieged Alexandria, but the intervention of the Romans caused him to retire. He re-established Philometor as king at Memphis, and returned to Syria. After his withdrawal Philometor came to an understanding with his brother. He agreed to marry his sister Cleopatra, and to reign jointly with Euergetes. In consequence of this reconciliation Antiochus again invaded Egypt, and advanced to Alexandria, but on the peremptory demand of the Romans he again retired to his own dominions, B.C. 168. Dissensions now broke out between the brothers, and Philometor being expelled from Alexandria repaired to Rome B.C. 164. By the intervention of the Romans he was replaced, but agreed to erect Cyrene into a separate kingdom for Euergetes, who afterwards persuaded the Romans to grant him Cyprus also. This occasioned long disputes and negotiations, but Philometor finally retained Cyprus, which he defended by force of arms. In the dispute between Demetrius Soter and Alexander Balas for the possession of Syria, Philometor supported the latter, and in B.C. 150 gave him his daughter Cleopatra in marriage; but Alexander having repaid his alliance with treachery, he concluded peace with Demetrius, gave Cleopatra to him, and conquered Syria on his behalf. He died in battle against Alexander, in which the latter was defeated, B.C. 146. In the later part of his reign he showed an energy of which he did not at first appear capable, and he is generally praised for

the mildness and moderation of his character. During his reign a great migration of Jews, caused by factions in their own country, took place from Palestine into Egypt.

PTOLEMY VII. (surnamed *Euergetes* and also *Physcon*) was King of Cyrene at the death of his brother. Cleopatra caused her infant son to be crowned; but Ptolemy invaded Egypt, and by the intervention of the Romans it was agreed that he should marry Cleopatra and be recognized as king. Immediately after the marriage he put his nephew to death. His reign was one of tyranny and bloodshed, and by his violence he drove the citizens of Alexandria to exile themselves in great numbers. He divorced Cleopatra in order to marry her daughter by Philometor, who bore the same name. He was compelled at length to flee from the indignation of his subjects, and escaped to Cyprus B.C. 130. Here he perpetrated further atrocities, but Cleopatra having made herself unpopular by applying to Syria for aid against him he was restored to the throne of Egypt B.C. 127. He afterwards intervened in the affairs of Syria, became reconciled to his sister Cleopatra, whose son to himself he had barbarously murdered, and died B.C. 117 in peaceable possession of the throne of Egypt. This monster was not only a patron of literature, but himself the author of a considerable work on natural history.

PTOLEMY VIII. (surnamed *Soter II.*, and also *Philometor*, *Lathyrus*, and *Philadelphus*) was the son of the last Ptolemy by his niece Cleopatra. He was already married to his sister Cleopatra at the time of his accession. His mother compelled him to divorce her and marry his younger sister Silene, in spite of his preference for Cleopatra, and for ten years she continued to sway the government, although she and her son were frequently opposed in policy. She at length accused him of conspiring against her life, and he was compelled to flee, B.C. 107. For eighteen years he continued to hold Cyprus as an independent kingdom. During this period he took part in the wars of Syria, and in B.C. 103 defeated Alexander Jannæus, king of Judæa, and made himself master of the coasts of Palestine. His mother thereupon marched against him with an army, and he finally retired to Cyprus. During subsequent wars they were constantly opposed to each other. After the death of Cleopatra (B.C. 90) he was recalled to Egypt, which he governed till his death in B.C. 81. Thebes revolted and held out against him for three years. He was succeeded by his daughter Cleopatra.

PTOLEMY IX. (otherwise called *Alexander I.*) was the youngest son of Ptolemy VII. by his niece Cleopatra. On the death of his father his mother wished to place him on the throne, but failing in this she sent him to Cyprus, where three years after he assumed the title of king. On the expulsion of Ptolemy VIII. he was recalled by his mother, and shared with her the throne of Egypt, although he appears to have had little power. The violence of his mother at length caused him to flee; but being persuaded to return, and suspecting her of designs against his life, he caused her to be assassinated. After reigning a year he was expelled by an insurrection of his people and soldiers, who recalled his brother. He was killed in battle at Cyprus B.C. 81-80.

PTOLEMY X. (or *Ptolemy Alexander II.*), son of the preceding, was nominated king of Egypt by Sulla on the death of Ptolemy VIII.; but the Egyptians having already placed Cleopatra Berenice, the daughter of that king, on the throne, it was arranged that he should marry her and admit her to a joint sovereignty. Nineteen days after the marriage he caused her to be assassinated, upon which the Alex-

andrians rose in insurrection, dragged him to a gymnasium, and put him to death B.C. 80.

PTOLEMY XI. (*Auletes*—surnamed *Neos Dionysus*), an illegitimate son of Ptolemy VIII., succeeded Ptolemy X., with whom the legitimate race of the Lagides became extinct. The early part of his reign appears to have been distinguished by no political transactions of importance. In vice and debauchery he appears to have rivalled the worst of his predecessors. To procure the ratification of his title, which was long delayed, he gave immense bribes to the Romans, and the oppressive taxes he was thus compelled to impose caused his expulsion by the Alexandrians in B.C. 58. He repaired to Rome to procure his restoration, and when the Alexandrians sent deputies against him he caused them to be waylaid and murdered. In consequence of this a strong opposition was excited to his claim, and he withdrew to Ephesus in disgust, but in B.C. 55 A. Gabinius, proconsul of Syria, by the influence of Pompey and a bribe of 10,000 talents, was induced to restore him. The Egyptians, who had placed Berenice, the daughter of Ptolemy, on the throne, were defeated, and Ptolemy put Berenice to death. During the rest of his reign Egypt was occupied by the Romans, and the revenues collected to defray his obligations to them. He died B.C. 51.

PTOLEMY XII. (*Auletes*), son of the preceding, reigned jointly with his sister Cleopatra till B.C. 48, when Cleopatra was expelled, and raising an army in Syria invaded Egypt. It was at this time that Pompey landed in Egypt after his defeat, and was assassinated by Pothinus and Achillas, the ministers of Ptolemy. On the arrival of Cæsar Cleopatra by her charms acquired an ascendancy over him, which made it manifest that he would decide her dispute with Ptolemy in her favour. Thereupon Pothinus raised an insurrection against Cæsar. Ptolemy put himself at the head of the insurgents, was defeated by Cæsar, and drowned in attempting to make his escape in B.C. 48 or 47.

PTOLEMY XIII. (*Auletes*), the youngest son of Ptolemy XI., was declared king by Cæsar in conjunction with Cleopatra in B.C. 47. He was married to his sister, but being only a boy possessed no more than the name of husband or king. He was put to death by Cleopatra in B.C. 43. See Dr. Smith's Dictionary of Greek and Roman Biography and Mythology.

PTOLEMY (CLAUDIUS PTOLEMÆUS), the celebrated astronomer and geographer. Neither the time nor place of his birth, nor any of the events of his life, is known. He appears to have resided in Alexandria, where he made astronomical observations in 139, and he was alive in 161. He was the first systematic writer on Greek astronomy whose works are now extant; but his astronomical labours are chiefly based on those of Hipparchus (see HIPPARCHUS), who lived about 300 years before him, and whose calculations he adjusted to his own time. Ptolemy's great astronomical work is entitled *Megalê Syntaxis tês Astronomias*, and is more commonly known by the Arabic title *Almagest*. It contains an exposition of the system of the world, of the order and revolutions of the heavenly bodies, a treatise on rectilinear and spherical astrology, and a complete description of the astronomical instruments used by the Greeks. His system, founded on the apparent movements of the heavenly bodies, and which is still known by his name, was only superseded by that of Copernicus. His *Geography* (*Geôgraphikê Huphêgêsis*) is a work of equal historical importance. As an authority it maintained its ground till the commencement of maritime discovery in the fifteenth century. It contains little descriptive information, but gives a com-

plete list of names of places, with their longitudes and latitudes as received in his time. The latitudes are generally based on accurate observation; but the longitudes, founded on a false assumption of the extent from east to west of the known world, which he made much greater than the reality, are very inaccurate. This occasioned the error in the calculations of Columbus and his contemporaries as to the distance west of Europe of the eastern shores of India, which they made too short, and consequently to the early supposition that America was India. The chief authority followed by Ptolemy in his geography is Marinus of Tyre.

There are numerous other works of Ptolemy's extant, among which may be mentioned a chronological catalogue of the kings of Persia, Greece, and Rome, which has been found valuable to historians; a treatise on the theory of the musical scale, two astrological treatises, and several other works on mathematics, astronomy, optics, and other sciences. The best edition of the *Almagest* is by Halma (Paris, two vols. 4to, 1813-16), of the *Geography*, by Nobbe (Leipzig, 1843), Muller (Paris, 1883); there are two vols. of miscellaneous works of Ptolemy published by Halma (1819-20).

PUBERTY, the period in both male and female marked by the functional development of the generative system, and by a corresponding aptitude for procreation. This period is marked in both man and woman by certain characteristic signs. In the male puberty is generally attained between the age of fourteen and sixteen years in temperate climates; and although this period may be reached at an earlier age in warm regions, yet, as will presently be noticed, climatic conditions do not appear to affect the male in so prominent or marked a degree as the female. Previously to the attainment of the age designed by nature as that at which the generative functions assume their functional activity, the physical powers have been appropriated to the nutrition of the frame. This fact is in accordance with a well-known and reasonable law of physiology, whereby the processes of nutrition and reproduction are found to be antithetical to each other—in other words, the reproductive energies of the body are opposed to the nutritive, and act as an important drain upon the physical and nutritive powers. No law seems more clearly established than this, and therefore it is that we find the generative instincts limited or restrained until a period when the nutrition and growth of the being has been duly advanced.

In man the occurrence of puberty is marked by a varied and general change in the entire physical constitution of the individual. The body attains, within a comparatively short period, a large relative increase in size. The form acquires greater fullness and stamina. The larynx particularly enlarges, and the voice attains the deeper pitch of the manly estate. The chin and pubis become covered with hair, and the entire sexual system receives an unwonted stimulus, the testes secreting the seminal fluid characteristic of full sexual vigour. As time passes the changes thus inaugurated become more and more intensified, the full assumption of the form and mind of the man completing the more marked period of puberty. The male thus becomes sexually perfect. The sexual powers in man are retained to a much later period of life than in woman. Instances are on record in which they have been retained till the age of 100—as in the well-known case of old Parr. But in ordinary cases the virile powers of man visibly decrease after the age of fifty or sixty years; the energies of declining years being, as in childhood, withdrawn from the reproductive, and again devoted to the nutritive interests of the individual.

In woman the period of puberty is much more important than in man, for the reason that changes of a much greater extent are thereby induced, and certain important processes in connection with the sexual instincts are then for the first time brought to functional perfection. In the female, therefore, we find that the epoch of puberty commences in temperate climates from the thirteenth to the sixteenth years. But it is notable that in females puberty may be attained at a much earlier age, or may be greatly delayed; the explanation of these anomalous cases depending rather upon individual constitution and hereditary peculiarities than upon causes of a more general kind. It appears as a rule to be attained at an earlier period in tropical climates, in those delicately nurtured, and in the inhabitants of towns, as opposed to the ill-fed or country residents. At this period, and more markedly than in man, the female form acquires a fullness and roundness of characteristic kind. The breasts enlarge, depositions of fat taking place in the mammae and on the pubes, and over the body generally. The internal organs of generation also enlarge, and their functional perfection in woman is marked by the most unequivocal of the signs of puberty, namely, the appearance of *menstruation* (which see), or the *catamenial discharge*. This latter consists of a flow of blood from the internal generative organs; but as explained in the articles *MENSTRUATION*, *OVARY*, and *OVUM*, this sanguineous flow is only to be regarded as symptomatic of the true and deeper process of *ovulation*, or the discharge of ova or eggs from the ovary. The occurrence of ovulation, or in other words the production of ova, liable and ready for fertilization, and so to develop a new being, is the most essential and significant sign of the full attainment at once of puberty and of the true female generative functions.

Puberty in both man and woman may be retarded or advanced by individual peculiarities of constitution, and, as already remarked, by the surrounding circumstances of life. Regarding the influence of climate it has been argued that women, like plants, attain maturity soonest in tropical climates. The real facts of the case appear to be (as demonstrated by Mr. Robertson of Manchester, in his *Essays on Menstruation*, &c., 1851) that in temperate climates the occurrence of puberty is extended over a longer range of ages, or series of years, than in tropical climates; although, *ceteris paribus*, the inhabitants of warm regions attain to maturity at an earlier age than those of cold latitudes. This may, of course, be partly due to the general influence of heat and food in determining an earlier development of all the physical functions, in which development the generative organs would of course readily participate. The average period of puberty and the average of early dates are thus found to exhibit no very great difference in the inhabitants of cold and warm climates. Exceptional instances occur in which civilizing or other influences may affect the appearance of puberty. Notably in the case of Hindu females puberty is attained uniformly at a period about two years before its occurrence in Europeans; the average period in the Hindu female at which puberty occurs being thirteen years, and that in the British female fourteen years eleven months. A larger proportion of the first menstruations of Asiatic women occurs in the earlier years of the period over which puberty ranges in British women, as has been clearly shown by a table drawn up by Mr. Robertson. It is further stated that the negroes of Demerara and the West Indian Islands generally, the temperature of which countries is higher than that of India, do not attain puberty earlier than the peasants of England. The cause of early puberties in the Hindus and other eastern

nations is probably to be found in the sexual habits and laws of marriage of these nations, together with hereditary influences dependent upon these customs.

The cessation of the catamenial flow, and the stoppage of the generative functions in woman, generally occur about the forty-fifth year of life; the aptitude for procreation in woman ceasing more definitely and regularly, and at a much earlier period, than in man. Cases are rare in which children have been born by mothers exceeding fifty years of age.

PUBLICANI, farmers of the public revenue in the Roman state. The revenues derived from the tribute of foreign countries were sold or let for a period by the censors in Rome to the highest bidder. The sale was generally made for a *lustrum* or period of five years. The conditions of the sale were generally determined by law, but were sometimes modified on particular occasions. The tithes of Sicily, except those of wine, oil, and garden produce, were by a custom introduced by Hiero not sold in Rome but in Sicily. The farmers of the revenue belonged to the wealthiest classes, and during the later period of the republic were generally of the equestrian order. They were required to give security to the state for the price at which they purchased any branch of the revenue, and for this purpose they generally united in companies, recognized by the state, and called *socii*, which divided the venture into shares (*partes*). The contract with the state was made in the name of one responsible individual, called *maniceps*, and the business manager of the company was called *magister*. The *magister* resided at Rome and corresponded with the agents in the provinces. None but Roman citizens could be a member of a company of publicani, and magistrates and governors of provinces were excluded from them. The actual work of collection was conducted by an inferior class of servants of the company, who might either be freedmen or slaves, Romans or provincials. To this class belong most of the publicans mentioned in the New Testament.

PUBLIC HEALTH ACTS. Besides general and particular acts against nuisances the necessity for general measures for protecting the health of towns has given occasion to special legislation. An act known as the Public Health Act, 1848, was passed in that year (11 and 12 Vict. cap. lxiii.), appointing a general board of health, with subordinate local boards throughout the country, with power to levy rates and regulate matters concerning the public health. This act has been several times amended, particularly by the Public Health Act, 1875. This act, like the act of 1848, does not apply to Scotland or Ireland, nor to the metropolis, except as regards special provisions. Under its introductory provisions sanitary districts are divided into urban and rural, the former being limited by the sanitary jurisdiction of corporations, improvement commissioners, and local boards, the latter by that of boards of guardians. Part 3 consists of what are specially termed sanitary provisions. It is divided into the heads of:—1, sewerage and drainage; 2, water-closets, privies, &c.; 3, scavenging and cleansing; 4, water supply; 5, regulation of cellar dwellings and lodging-houses; 6, nuisances; 7, offensive trades; 8, unsound meat, &c.; 9, infectious diseases and hospitals; 10, prevention of epidemics; 11, mortuaries. Each head includes the corresponding statutory regulations, together with the penalties by which they are to be enforced. Part 4 contains under several heads the law on such matters of local government as are only indirectly connected with the question of public health. These heads are:—1, Regulations with regard to highways and streets, including the power for widening, improving, paving, and lighting them; 2, public pleasure-grounds; 3, markets and slaughter-houses; 4, police

regulations. Part 5 relates to the general powers and methods of which local authorities may avail themselves. It defines their power to enter into contracts, to purchase lands, to have recourse to arbitration, to make and alter bye-laws, to appoint officers, including the medical officer of health, and it regulates the mode of conducting their business. Part 6 relates to powers of rating and borrowing, and contains full provisions for the assessment of general district rates, private improvement rates, and highway rates. The expenses of rural authorities are dealt with by a division into general and special heads, the former being payable from a common fund, and the latter being a special charge on each contributory place, both being chargeable on the poor-rates. Borrowing powers are defined and regulated, and due provision is made for audits. Part 7 relates chiefly to the prosecution of offences, the recovery and application of penalties, and the service of notices. Part 8 defines the powers of the Local Government Board in the alteration of areas and union of district exercised by provisional orders and otherwise, including the power to invest rural authorities with all or some of the powers granted to urban authorities. Any urban or rural districts may be united either for the purpose of procuring a common supply of water, or of carrying into effect a common system of sewerage, or for any other purposes of the act. Districts may be united for the purpose of appointing a more competent officer of health. Port sanitary authorities are constituted under this head, and their jurisdiction and powers defined. Part 9 sets forth the powers possessed by the Local Government Board upon default of the local authorities, and the provisions for the recovery of expenses consequent upon such default, and the power of the Board to alter and repeal local acts, and to settle differences consequent upon the transfer of powers and duties of the various local authorities. Part 10 consists of a collection of provisions not included under the previous heads. Various saving clauses relating to navigation and water rights, and to certain exemptions of a local nature, bring the act to a close. The act of 1875 has been supplemented by others dealing with water-supply, removal of nuisances, pollution of rivers, the improvement of the dwellings of the working classes in large towns, &c. The chief Public Health Act for Scotland is that of 1867. A special Public Health Act for London was passed in 1891. See also LOCAL GOVERNMENT.

PUBLIC-HOUSES. See INN AND INNKEEPER, and LICENSING ACTS.

PUBLIC STOCKS OR FUNDS. See FUNDS.

PUBLILIUS SYRUS, so called because a native of Syria, was carried as a slave to Rome when a mere boy, but was fortunate in meeting with a kind master, who, perceiving his talents, gave him a good education, and afterwards set him free. His talent was particularly displayed in writing *mimi*, or farces, at a time when that species of drama was most in fashion; and Julius Cæsar, with whom he was contemporary, preferred him to all his competitors. His farces were interspersed with moral sentences, a collection of which is stated by St. Jerome to have been made and used by the Romans as a school-book. A number of these apothegms, forming the only fragments of his works still extant, have been published in various collections of Latin authors under the title of *Publii Syri Sententiæ*.

PUCK (Old Swedish, *puke*; Icelandic *puki*, an evil demon, a word equivalent to Irish *púca*, Welsh *pwca*, an imp), in mediæval mythology a celebrated fairy, 'the merry wanderer of the night'; he was also known by the names of Robin Goodfellow, Friar Rush, Pug, &c., in England; and in Germany by that of Knecht

Raprecht, although in both countries he is best known by his designation of Puck. Under the latter appellation his character and attributes are represented in Shakspeare's *Midsummer Night's Dream*. He was chief of the *brownies* or domestic fairies, and many tales are told of his nocturnal exploits.

PÜCKLER-MUSKAU, HERMANN LUDWIG HEINRICH, PRINCE OF, a German traveller and author, was born at Muskau, Saxony, 30th October, 1785. After having studied law at Leipzig from 1801 to 1803 he entered the army, which he soon after quitted with the rank of captain, and travelled in Italy and France. In 1813 he entered the Russian service as major, and subsequently was appointed an aid-de-camp to Prince Charles Augustus of Saxe-Weimar. Having greatly distinguished himself in the Netherlands he received the rank of lieutenant-colonel, and later on was appointed civil and military governor of Bruges. On the conclusion of peace he retired to his estates and devoted himself to literature and horticulture; he also travelled a good deal. In 1822 he was created a prince by the King of Prussia. He travelled in France and England in 1828, and subsequently spent several years travelling in Asia and Africa. Some time after his return he sold his estates at Muskau and passed his time in various parts of Germany and Italy. In 1863 he was elected a member of the Prussian *Herrenhaus*, or Chamber of Peers. He was on the staff of the King of Prussia during the war of 1866, though then in his eighty-first year; and he died Feb. 4, 1871. His writings, which are numerous, are of a lively and original description; among them his letters from England, translated under the title, *The Tour of a German Prince* (three vols. London, 1831), attracted considerable attention from its familiar pictures and revelations of aristocratic life. Other works of his are *Briefe eines Verstorbenen* (Munich and Stuttgart, 1831), *Semilasso's vorletzter Weltgang* (ib. 1835), *Semilasso in Africa* (ib. 1836), *Aus Mehemed Ali's Reich* (ib. 1844), and *Die Rückkehr* (Berlin, 1846-48).

PUDDINGSTONE, the name given by geologists to a conglomerate composed of rounded fragments of different sorts embedded in a siliceous matrix (like fruit in a plum-pudding). The puddingstones abound among stratified rocks, where they occur in beds, masses, veins, and boulders of greater or less size. The puddingstones may form rounded hills, and sometimes even mountains, as in the Vosges.

PUDDLING FURNACE. See IRON.

PUDSEY, a municipal borough of England, in the West Riding of Yorkshire, on the brow of a lofty acclivity above the valley of the Aire, 6 miles west of Leeds. It has recently increased from a few scattered hamlets to a considerable town; and has a spacious and elegant modern church, with an embattled and pinnacled tower; several dissenting places of worship; spacious board and other schools; mechanics' institute, &c. Woollen and worsted manufactures are extensively carried on, and there is also a large manufacture of boots and shoes. There are many building-stone quarries in the vicinity. Pop. in 1891, 13,444; in 1901, 14,907.

PUEBLA, LA, one of the states of the Republic of Mexico; bounded south by the Pacific, and surrounded on other sides by Vera Cruz and Oaxaca; area, 12,042 square miles. Its centre is intersected by the Cordillera of Anahuac, in which is the volcano of Popocatepetl, the next highest mountain in Mexico. Its principal river is the Nasca. The soil is fertile in corn, maize, and fruit-trees. Cotton, sugar, and other tropical productions also succeed well; and there are besides silver-mines and quarries of excellent marble. The principal towns are La Puebla, Tepeaca, and Tehuacan. Pop. (1900), 1,024,446.

PUEBLA, LA. the capital of the above state, is finely situated on a declivity, 74 miles E.S.E. of Mexico, next to which it is the largest city in the confederation. It has wide, regular, and well-paved streets, supplied with footpaths; houses generally three stories high, with flat roofs; large and elegant squares, in the principal one of which is situated the cathedral, a magnificent structure. There are numerous large churches, many of them highly decorated; and above 100 towers rising above the houses impart a characteristic feature to the city. There are also several colleges, a town-hall, an episcopal palace, a museum, academies, schools, alms-houses, and hospitals. The principal manufactures consist of cotton, paper, glass, earthenware, leather, and soap. Puebla was founded by the Spaniards in 1531. It was temporarily surrendered to the French, after undergoing a siege of three months' duration, in May, 1863. Pop. (1895), 58,681.

PUERPERAL FEVER, a disease peculiar to women in childbed. It is far from being either a simple or an unvarying malady, as it assumes the most diverse types and forms, and is considered the most fatal disease to which women in this state are liable. It is no longer doubtful that it is a contagious disease, capable of assuming an epidemic form. The cause of the disease is of the nature of a blood poison, and may be carried from one patient to another by accoucheur or nurse on the hands or clothing. At the same time, the disease may be due, not to any poison introduced from without, but to the absorption of decomposing material derived from retained membranes or retained portions of the after-birth. The symptoms and characteristic features of the disease vary very much, according to the circumstances that occasion it and influence its course. It usually attacks the patient about the third day after delivery, and is generally preceded or attended by shivering and sickness or vomiting, and is marked by pain in the belly, which is sometimes very extended, though in other cases it is at first confined to one spot. The abdomen very soon becomes swelled and tense, and the tension rapidly increases. The pulse is frequent, small, and sharp; the skin dry and hot; the tongue brown and dry, and little brown masses (*acords*) form on the lips; the patient is thirsty, she vomits frequently, and the milk and lochia usually are obstructed. The symptoms often come on very acutely, but they may also approach insidiously. But whether the early symptoms come on rapidly or slowly, they soon increase, the belly becomes as large as before delivery, and is often so tender that the weight of the bed-clothes can scarcely be endured; the patient also feels much pain when she turns; the respiration becomes difficult, and sometimes a cough comes on, which aggravates the distress; or it appears from the first to be attended with pain in the side as a prominent symptom. Sometimes the patient has a great inclination to belch, which always gives pain. The bowels are either costive, or the patient purges bilious or dark-coloured faeces. These symptoms are more or less acute according to the extent to which the peritoneum is affected. In fatal cases the swelling and tension of the belly increase, the vomiting continues, the pulse becomes very frequent and irregular. The patient has unrefreshing slumber and sometimes delirium, but she may remain sensible to the last. The disease requires prompt and skilful treatment. The treatment, however, varies according to the form of the disease, and even in the same form various and often opposite modes of treatment are recommended by different physicians. The truth seems to be that no very definite knowledge either of the pathology or the treatment of this malady has as yet been

attained. Of the utmost importance in the treatment is the maintenance of the strength of the patient by the frequent administration of easily-digested nourishing food and by stimulants. Of equal necessity is the removal of any putrefying material from the womb and generative passage and maintaining their cleanliness by the use of the anti-septic douche.

PUERTO-CABELLO, or **PORTO-CABELLO**, a fortified maritime town of Venezuela, in the state of Carabobo, on the Caribbean Sea, 22 miles north by west of Valencia, to which there is a railway. It is well built, has a safe and commodious harbour, and though very unhealthy carries on a considerable trade, chiefly with the United States and Europe, exporting coffee, cacao, &c. Pop. about 14,000.

PUERTO-DE-LA-CRUZ-DE-OROTAVA, a seaport town in the Canary Islands, on the south coast of the island of Tenerife. It has paved and clean streets; five squares, in one of which is a pretty alameda; a town-house, a prison, an hospital, two churches, and two schools. Agriculture is the chief occupation of the inhabitants. The anchorage is bad. Some trade by sea is still carried on, but much less than formerly. Pop. 4700.

PUERTO-DE-SANTA-MARIA (Port St. Mary), a city of Spain, in Andalusia, in the province and 7 miles N.E. of Cadiz, on the right bank of the Guadalete, here crossed by a fine suspension bridge, near its mouth in the Bay of Cadiz. It is on the railway from Seville to Cadiz. The houses are generally built like those of the latter city, but are more spacious, and have much external decoration in glass and painting, and the streets are generally broad and well paved. It has a town-house; a pretty theatre; a bull-ring, where was given the grand bull-fight to the Duke of Wellington described by Lord Byron; five promenades, one of them planted with orange and other trees; infantry and cavalry barracks; a custom-house, a good edifice near the mole; a court-house; a parish church in the Gothic style; &c. Leather, soap, hats, wines, liqueurs, &c., are manufactured, and some fishing is carried on. This is one of the Spanish ports from which sherry is exported, but the vineyards have latterly suffered greatly from the phylloxera. Its vicinity to Cadiz, the centre of exchange, is favourable to business. The principal articles of import are wood and iron. Steam-boats ply regularly between the Puerto and Cadiz. Pop. (1887), 20,590.

PUERTO-PRINCIPE, an inland city of Cuba, capital of the central department, 325 miles south by east of Havana. From its inland position and want of water carriage the trade of this place bears no just proportion to the number of its inhabitants. Its produce, chiefly sugar, cigars, tobacco, wax, and honey, is shipped through the Bay of Nuevitas, 40 miles north-east, by which also it receives its foreign supplies, there being direct railway connection with the bay. Pop. (1839), 25,102.

PUERTO-REAL, a seaport of Spain, in Andalusia, in the province and 7 miles east of Cadiz. It has straight and rather broad streets, several squares, in one of which stand the town-house, prison, and public granary. It also has a church, several schools, an oratory, a poor-house, a mole, and slip; and manufactures of coarse linens, leather, pottery, vernicelli, and starch. Pop. (1887), 9694.

PUERTO-RICO. See **PORTO-RICO**.

PUFENDORF, SAMUEL, BARON VON, one of the first and greatest expounders of natural law, publicists, and historians of Germany, was born January 8, 1632, near Chemnitz, in the Erzgebirge, in the village where his father was a Lutheran preacher. After having studied at the school of Grimma, he

proceeded to the University of Leipzig, where he studied theology and law, and afterwards in 1657 to Jena, where he grounded himself in the Cartesian philosophy and in mathematics. Being unable to procure a situation in his native country, he accepted in 1658 the place of tutor in the house of the Swedish ambassador at the Danish court, and repaired with his pupil to Copenhagen; but a war breaking out between Denmark and Sweden, he was arrested, with the whole family of the Swedish ambassador. In this situation, which continued for eight months, he employed himself in studying the works of Grotius and Hobbes on law and government. The result of his labours appeared at the Hague in 1660 in a work entitled *Elementa Jurisprudentiæ universalis*. The learned elector of the palatinate, Charles Louis, to whom it was dedicated, was so much pleased with this work that he founded for the author in 1661 at Heidelberg a professorship of the law of nature and of nations, the first in Germany. Here he taught till 1670, and in addition to his professional duties wrote his work *De Statu Rei Publicæ Germanicæ*, which he published in 1667 under the pseudonym of Severinus Mozambano, and which, from the hardy way in which some of the glaring imperfections of the Germanic constitution are exposed, raised a perfect storm of controversy. Partly with a view to escape the unpleasant consequences which a revelation of the authorship of the work might occasion, Pufendorf accepted in 1670 the post of professor of natural law in the university at Lund, offered him by Charles XI. of Sweden. He there wrote his work on natural law (*De Jure Naturæ et Gentium*, Lund, 1672), which superseded the former, and is characterized by perspicuity, method, and sound reasoning; soon after appeared the smaller compendium, or rather abstract of the above work (*De Officio Hominis et Civis*, Lund, 1673), which has passed through innumerable editions and been translated into several languages. Pufendorf in these works deviated still further than Grotius from the scholastic method of philosophizing, and consequently excited violent opposition. However different opinions may be respecting these works of Pufendorf, it is not to be denied that he made an epoch in the history of natural law. He had a more distinct conception than Grotius of a science which, independently of positive law or theology, should determine the rules of right solely by the laws of reason. His law of nature was a philosophical morality settling the mutual relations of justice between men, and which still remained dependent on the Christian morality. With Grotius he laid the foundation of law in the social instinct, which is nearly allied to the Christian precept of love of our neighbour, and with Hobbes he derived law from the state of fallen nature. Some years afterwards Pufendorf went to Stockholm, where he was appointed secretary of state, royal counsellor, and historiographer. There he wrote in Latin the History of Sweden from the Campaign of Gustavus Adolphus in Germany to the Abdication of Queen Christina (*De Rebus Sueciciæ*, 1676), and the History of Charles Gustavus (*De Rebus a Carolo Gustavo gestis*, two vols. folio, 1696), and in German his *Einleitung zur Geschichte der vornehmsten Reiche und Staaten* (1682, three vols.), subsequently continued by Oehlenschläger, and translated by Martiniers into French. These works so much increased his reputation that in 1686 he received from Frederick William, elector of Brandenburg, an invitation to Berlin as counsellor, historiographer, and judge of the supreme court of judicature, with the charge to write the life of that prince, which he finished under the reign of his son Frederick III. In 1690 he was made privy-councillor of the Elector of Brandenburg,

and in 1694 was created baron by Charles XI., king of Sweden. The works of Pufendorf, otherwise valuable, have the misfortune to be written in a very bald and uninteresting style. He died at Berlin in 1694.

PUFF-ADDER (*Vipera* or *Clotho arictans*), a serpent found at the Cape of Good Hope and in Southern Africa generally, and included in the *Viperidæ* or *Viper* family. Its popular name is derived from the fact that it possesses the power of puffing out or distending the upper part of the neck when irritated or alarmed. As in all other *Viperidæ* a poison apparatus exists, this form being specially dreaded on account of its highly venomous properties. The head is short, flat, and very broad. It attains a length of 4 or 5 feet. The body in some specimens may average a man's arm in thickness. The tail is tapering. The colour is darkest on the upper parts, and is of a brown tint, marked with patches of darker brown and white. A band or stripe of reddish colour exists between the eyes. The Puff-adder chiefly inhabits sandy tracts. A distinct demarcation between the head and neck is to be perceived. As in other *Viperine* Snakes, no pits exist in the sides of the face, and the upper jaw bears two canaliculated or perforated poison-fangs only, and is destitute of true or ordinary teeth. Several species or varieties of this form exist in South Africa. The Boesjesmen use the poison of this snake for the purpose of rendering their arrows venomous. The Puff-adder is said to be readily destroyed by the juice or oil of tobacco.

PUFF BIRDS. See **BARBETS**.

PUFFIN (*Fratercula* or *Alca arctica*), a genus of *Natatorial* Birds, included in the *Alcidæ* or *Auk* family, and thus belonging to the *Brevipennate* section of the order. The Puffin averages about 13 inches in length. It is the commonest of the British *Alcidæ*, and appears on our coasts in April and May to breed, departing southwards to Spain, Italy, and Southern Europe about August. The Puffin occurs on the northern coasts of Europe and on the eastern side of the North American continent. The beak of these birds is of large size and singularly compressed. It is deeply furrowed by three grooves on each side of the mandible. The colours of the beak also add to its singular appearance; this structure being coloured bluish-gray at its base, orange-red in the middle, and bright red at the tip. The body is short, stout, and rounded. These birds excavate burrows in sandy ground, each depositing a single egg of white colour. They are able to bite and scratch severely by means of their bills. The Puffins swim and dive with great ease; their food consisting of the smaller fishes, and chiefly the young of the sprats and herrings. They are caught and their flesh salted for food by the inhabitants of the Orkney and Shetland Islands. The Puffins occur around the Isle of Wight and off the coast of Anglesea in great numbers, but they are very generally to be met with round all the British coasts. The appearance of the bill in these birds has gained for them the popular names of 'Coulter-nebs' and 'Sea-Parrots'. The Puffin is figured at the art. **ORNITHOLOGY** (Pl. VII.).

PUGATSCHEF, JEMELJAN, the son of a Cossack, born at Simoweisk, a village on the Don, in 1726, played for a short time an important part in Russia. War and robbery were the employments of his youth, and he became the leader of a predatory band. He afterwards entered the Prussian service during the Seven Years' war; then joined the Austrians, served against the Turks, and was present at the siege of Bender (1770). Returning to his native country, he attempted to sow the seeds of rebellion among his countrymen, but was soon arrested and confined at Kasan. Having made his escape,

he was joined by some restless spirits, and was encouraged, by his personal resemblance to the lately deceased emperor, Peter III., to attempt to pass himself off for that emperor. The insurrection began in the middle of August, 1773, when a manifesto was issued in the name of the pseudo Peter. The number of his followers, which was at first only nine, had increased in September to 300. He was everywhere joined by his countrymen and the peasantry, to whom he promised deliverance from their oppressions. His force was increased by 500 deserters from the garrison of Jaizkai and many Roskolicians (which see), and he took several fortresses, practising the most shocking cruelties. His army now amounted to 16,000 men, and was gaining strength by the concurrence of Bashkirs, Wotiaks, Tartars, &c. He captured Kassy, the old capital of the empire, and passed the Volga. He was at length defeated at the moment that Moscow was threatened, betrayed by his followers to Suwaroff, and (June 10, 1775) executed, together with the other rebel leaders at Moscow.

PUG-DOG, a small dog which forms a miniature resemblance of the bull-dog, and is only kept as a pet or house-dog.

PUGET SOUND, an inlet on the west coast of the U. States, in the state of Washington. It contains numerous islets, and forms the south portion of Admiralty Inlet, which communicates with the Pacific through San Juan de Fuca Strait. On its shores are Olympia, Seattle, and other rising towns.

PUGILISM. See **BOXING**.

PUGIN, AUGUSTUS WELBY NORTHMOKE, son of Augustus Pugin, was born in 1812, and under the instructions of his father, combined with a native enthusiasm, early displayed wonderful skill and facility in delineating architectural scenes and remains. One of his first employments was acting as assistant to the Grieves in painting the architectural displays for the performances at Covent Garden and Her Majesty's Theatre. His taste for Gothic art was next turned to account in designing the furniture for Windsor Castle, and in supplying Messrs. Rundell and Bridge with designs for mediæval plate. As one of the results, perhaps, of his ardent enthusiasm for mediæval art, he became a convert in 1834 to Catholicism, and devoted himself thenceforth to the illustration and revival of Gothic architecture in connection with the Roman Church. His treatises on Gothic Furniture and Iron Work appeared in 1835, and attracted considerable attention. In the following year he gave to the world a work entitled *Contrasts, or a Parallel between the Noble Edifices of the Fourteenth and Fifteenth Centuries and similar Buildings of the Present Day*, in which he expressed in no measured terms his views as to the present state of ecclesiastical architecture. Other works of Pugin were *The True Principles of Pointed or Christian Architecture*, published in 1841; *An Apology for the Revival of Christian Architecture* (in 1843); and a magnificent chromo-lithographic work, *The Glossary of Ecclesiastical Ornament*, published in 1844. Meantime his talents as a practical architect were actively employed, though it is somewhat remarkable that they were almost exclusively devoted to the construction of Roman Catholic places of worship. He was employed by Sir Charles Barry in the internal decoration of the houses of Parliament, and was connected with Mr. Hardman of Birmingham in the manufacture of the renowned Gothic brass-work, besides having a share in the manufacture of stained glass in the same town. Latterly his intellect gave way, overtaken by the incessant excitement and labour to which it was subjected, and he was obliged to be removed to a lunatic asylum. He temporarily recovered, but only

for a very short time, and expired at Ramsgate on 14th September, 1852.

PUGIN, AUGUSTUS CHARLES, architectural draughtsman, was born in 1762 in France, but settled about 1798 in London, where for many years he acted as assistant to the celebrated architect Nash. He afterwards supported himself by executing architectural drawings for engravers, and made the drawings of the buildings in Ackerman's *Microcosm* of London, first published in 1808. He was also the artist employed on a *Series of Views* in Islington and Pentonville, with Descriptions by E. W. Brayley. After this he began to devote his attention to mediæval architecture, and published between 1821 and 1823 a work in two volumes, entitled *Specimens of Gothic Architecture selected from various Ancient Edifices in England*. A work was then undertaken by him in conjunction with the celebrated John Britton, and *Architectural Illustrations of the Buildings of London* made its first appearance in 1824, and was completed in two quarto volumes. His chief production, in which Mr. Britton also co-operated, was *Specimens of the Architectural Antiquities of Normandy*, published between 1825 and 1828. The last works of Mr. Pugin were drawings for a publication entitled *Paris and its Environs Displayed, and Gothic Ornaments selected from various Buildings in England and France*. He was aided in the last by his son Augustin Pugin. He died on 19th December, 1832.

PULCI, LUIGI, an Italian poet, born at Florence in 1431, was the youngest of three brothers distinguished for their talents and learning. Of the circumstances of his life we know nothing but that he lived on terms of intimacy with Lorenzo de' Medici and Poliziano. His burlesque epic poem *Il Morgante Maggiore*, in which he relates the adventures and exploits of Rinaldo and the giant Morgante, is said to have been written at the suggestion of Lorenzo's mother, and to have been read as an entertainment at table. This poem, in twenty-eight cantos, is a clever parody on the chivalrous romances of the Carolingian period, which, invented by the French Trouvères, had been imitated by several of the Italian poets. Sometimes, however, forgetting the express object of his work, the poet delivers himself of passages of great pathos, in which he shows himself to be possessed of genuine poetic feeling. One feature of this poem is the skilful introduction of many of the Tuscan idioms, which furnishes us with one of the most valuable sources for gaining a knowledge of the early Tuscan dialects. Pulci cannot bear a comparison with Ariosto and Tasso; he cannot be denied to possess fancy, but he wants taste and judgment. His mixture of the grave, lofty, and sacred with the mean and burlesque, which is offensive to modern taste, was in accordance with the spirit of his age. This work of Pulci's was translated into English by Lord Byron. Pulci died in 1487 or 1488.—His brother BERNARDO was the author of some elegies and short poems.—Another brother, LUCA, wrote heroic epistles, a pastoral romance (*Driedeo d'Amore*), and an epic romance, probably the first in Italian (*Il Cirifo Calvaneo*).

PULCINELLO. See **PUNCHINELLO**.

PULLEY, a mechanical power. It consists of a circular disc of wood or metal, which has freedom to turn about an axis passing through its centre; it has a groove round its edge to prevent a cord from slipping off. If the axis is supported by a beam, or is in any way fixed in space, the pulley is said to be 'fixed.' A fixed pulley merely changes the direction of a pull in a cord, it gives no mechanical advantage. The pulleys shown at *MECHANICS*, figs. 10, 12, and 19, fig. 13 on the right-hand side, fig. 14 the last

to the right, fig. 15 the three above, are all fixed pulleys. All the other pulleys shown are movable—that is, their axes are not fixed. In fig. 11 a weight is suspended from the axle of the pulley; of this weight and the weight of the pulley itself one-half is supported by the beam, and only one-half by the hand; hence a single movable pulley has a mechanical advantage = 2. Instead of pulling directly upwards with the hand, it is customary to have the cord passing round a fixed pulley, as in fig. 13, so that the power may be a downward pull. By combining a number of movable pulleys a mechanical advantage may be obtained, depending on the mode of combination. Neglecting friction, the mechanical advantage may be calculated from the principle of 'virtual velocities;' but friction is usually very considerable in the pulley, and if it has to be taken into account in calculation special experiments must be made to suit the case in hand. The principle of 'virtual velocities' or of 'equal works' is that the power applied to a machine multiplied by the distance through which the point of application moves in a certain time in the direction of the power, is equal to the resistance overcome by the machine multiplied by the direct distance through which it is overcome. That is, the work done by the power is equal to the work done against the resistance or weight. Applying this principle to fig. 14, where the three movable pulleys are separate, and have separate strings, each string being attached at one end to a beam, passing round a pulley, and being attached at the other end to a second pulley, we find that if we take half the sum of the weight and bottom pulley we have the pull in the bottom string; add this pull to the weight of the next pulley, and take half for the pull in the next string; and so on. In fig. 15 a block containing three pulleys is fixed to the beam; a movable block containing three pulleys supports the weight; a string passes round all the pulleys, one end being attached to the fixed block, and at the other the power is applied. It is evident that when the power moves through 6 inches the blocks approach each other by the distance of 1 inch, and hence the mechanical advantage is six. In every case of this, which is the most common, combination of pulleys, the power is equal to the sum of the weight and of the movable block divided by twice the number of pulleys in the movable block. In these examples we have supposed the straight parts of the strings to be parallel to one another, and that no work is done against friction. When the cords are not sensibly parallel the mechanical advantage may still be calculated by applying the principle of virtual velocities. The amount of work lost in friction and in bending the string can only be determined from special experiments. The work lost in friction is nearly proportional to the weight lifted.

PULMONARIA, or **PULMONIFERA**, a term applied to groups of organisms which breathe air directly from the atmosphere, and respire by means of lung-sacs or analogous organs. The Pulmonaria or Pulmonary Arachnida form the highest division of the class Arachnida, and are represented by Spiders and Scorpions. They breathe by lung-sacs, each of which consists of an involution of the skin or integument, constituting a sac-like cavity in the side of the body, and to which air is admitted by apertures known as *stigmata* or *spiracles*. The pulmonary sacs contain a number of delicate plate-like structures or *lamella*, closely set together like the leaves of a book, which serve to support the ramifications of the minute blood-vessels, and so increase the respiratory area. In the Spiders, &c., *trachea* or breathing tubes similar to those of insects may be conjoined with the pulmonary sacs.

The term **Pulmonaria** is also applied to indicate one of the two main sub-classes into which the class of Gasteropodous Mollusca (see **GASTEROPODA** and **MOLLUSCA**) is divided. The name *Pulmo-Gasteropoda* is sometimes also used synonymously with Pulmonaria. In these Pulmonary Gasteropods, represented by the Snails and Slugs, respiration is performed by means of lung-sacs. These sacs are formed by a folding or inflection of the 'mantle' (which see), which thus forms a kind of chamber, to which air is admitted by a special aperture which can be opened or closed at the will of the animal. This chamber is usually placed towards the back or dorsal aspect of the animal, its aperture opening (as in Slugs) on the right side of the body near the neck. The roof and walls of this chamber are richly supplied with capillary blood-vessels, into which the blood destined for purification is sent. The floor of the chamber consists of a kind of muscular *diaphragm* or 'midriff,' by means of which the air can be expelled, or the dimensions of the chamber enlarged so as to admit a fresh supply of the aerating medium. See also **MOLLUSCA**, **LUNG**, &c.

PULMONARY CONSUMPTION. See **CONSUMPTION**.

PULO PENANG. See **PENANG**.

PULPIT (Latin, *pulpitum*), the elevated inclosure or desk in a church from which the preacher is wont to deliver his discourse and conduct other religious exercises. The term was also applied to the moveable desk from which disputants pronounced their dissertations and authors recited their works; and in the ancient Roman theatres it designated the front part of the stage, where the actors performed their parts. The *ambo* or *pulpitum* of the early Christians appears to have been applied to a different purpose from that for which the modern pulpit is used; it was the place from which parts of the service were sung or recited, and was large enough to contain several chanters. This use of it, however, was gradually superseded, as it came to be considered a convenient place from which the minister might deliver his homily. The pulpits of St. Lorenzo fuor delle Mura and St. Clemente at Rome are supposed to be the oldest now existing. The pulpit was long regarded as an architectural feature of the building, constructed sometimes of marble, but oftener of the same material as the building itself; and it frequently exhibited great elaborateness of structure. As a work of art one of the most celebrated pulpits is that in St. Gudule's at Brussels; it is made of oak, elaborately carved, and is supported by figures representing Adam and Eve expelled from paradise. Stone pulpits used to be common in the courts and cloisters of religious houses, and under the appellation of *preaching-crosses* they were also used for preaching in the open air, of which Paul's Cross furnishes a famous example.

PULQUE, or **OCTLI**, a favourite drink of the Mexicans, extracted from the maguey, or *Agave Mexicana*. At the moment of efflorescence the flower-stalk is cut out, and the juice destined to form the fruit flows into the cavity thus formed, and is taken out two or three times a day for four or five months. The sap in this state is called *aguamiel* (honey-water), and when allowed to ferment slightly forms an agreeable drink. The natives, however, prefer it after undergoing a further process of fermentation, in which state it is acid, and has a putrid kind of smell. When allowed to ferment still more it turns into vinegar, and when boiled down becomes syrup. Pulque brandy is made of it; and when water and sugar are mixed with the sap, and the whole allowed to ferment a few hours, the drink is called *tepache*.

PULSE, a general term applied to the pods or seeds of leguminous plants, such as pease, beans, lentils, &c. Good pulse is very nutritious, though not easy to digest.

PULSE (from the Latin *pulsus*, a beating, a blow), the motion of an artery, consisting of its alternate expansion and contraction, which in practice is considered as a beating. This motion is strongest in the heart, which is the centre of the arterial system, and from it is propagated through all the minutest branches of the arteries. In those which lie immediately under the skin it can be felt with the finger, as is the case with the radial artery, the pulsation of which is very perceptible at the wrist. (See **BLOOD** and **HEART**.) The state of the pulse is therefore an indication of the action of the heart and the whole arterial system, and of the condition of the blood and the physical functions in general. The circumstances to be attended to in the pulse are either the number of pulsations which take place in a given time, and the regularity or irregularity of their occurrence, or the character of each pulsation. In the former case the pulse is said to be quick or slow according to the number of pulsations in a given interval; regular or irregular, as they occur at equal or unequal intervals. In the latter case it is strong or weak, hard or soft, full or small, &c. It is affected by the age, sex, and temperament of the individual, and by accidental circumstances, as sleep, food, exercise, heat, &c. The pulse is most rapid in childhood, making from 100 to 110 beats in a minute, and is regular, and rather soft and small. In youth it is much less rapid, making not far from ninety beats a minute. At this period it is regular, strong, rather soft than hard, moderately full. In mature age the number of beats is about seventy-five per minute, and the pulse is regular, strong, or moderate, fluctuating between hard and soft, between full and small. In old age the number of beats sinks to sixty. The pulse is sometimes irregular, strong, but slow, hard, rather full than small. In the female sex it is more rapid, softer, and smaller than in the male. In the sanguine temperament (so called) it is quicker, fuller, softer; in the choleric, slower, harder, stronger; in the phlegmatic, slower, weaker, softer, fuller; in the melancholy, slow, hard, and strong. A vegetable diet makes it slow, weak, full, soft; a meat diet, spices, spirituous liquors, make it quick and hard. In a pure, clear air it is quick; in damp, impure air, slow and languid. Sudden agitation and violent passions make it rapid and irregular; joy makes it quick and strong; long-continued grief, languid and soft. The pulse is, therefore, a highly important indication of the state of the system. A deviation from the regular pulse of an individual indicates a disordered state. When the irritability of the system is so heightened as to produce fever or inflammation the pulse is accelerated. If the action of the nervous system is irregular, or unduly heightened, the pulse becomes frequent and irregular, as in the case of cramps and a diseased irritation in the abdomen, from worms, &c., and in hypochondriacal and hysterical persons. In case of mechanical obstructions to the circulation, as in dropsy of the pericardium, polypus in the heart or in the great arteries, the pulse is irregular and interrupted. It is doubtful whether Hippocrates had any knowledge of the pulse. Soon after his time, however, physicians, especially those of the Alexandrian school, were attentive to it. Aretæus of Cappadocia explained the pulsation as a motion occasioned by a natural and involuntary extension of the warmth belonging to the heart and arteries, by which their own motion is occasioned; and Athensæus of Cilicia had given the same explanation before him. He describes the various kinds of pulse connected with different dis-

orders. Galen wrote several works on the pulse. For several centuries after the doctrine of pulsation remained much as he had left it, as was the case, indeed, with many branches of medical science. The demonstrations of the circulation of the blood by Harvey, and of the irritability of the muscular fibre by Haller, threw new light on this subject. The feeling of the pulse is the principal examination which Chinese physicians make of the state of their patients, and they discriminate its different states with a minuteness bordering on absurdity.

PULTAWA. See **POLTAVA**.

PULTUSK, a town of Russian Poland, in the government of Lomza, partly on the right bank and partly on an island of the Narow, 32 miles N.N.E. of Warsaw. It has three churches, a synagogue, a convent of the Sisters of Mercy with an hospital, several old monasteries, a gymnasium, and a castle; a distillery, and some general trade. The Saxons were here defeated by Charles XII. in 1703, and the Russians by the French in 1806. Pop. 7689.

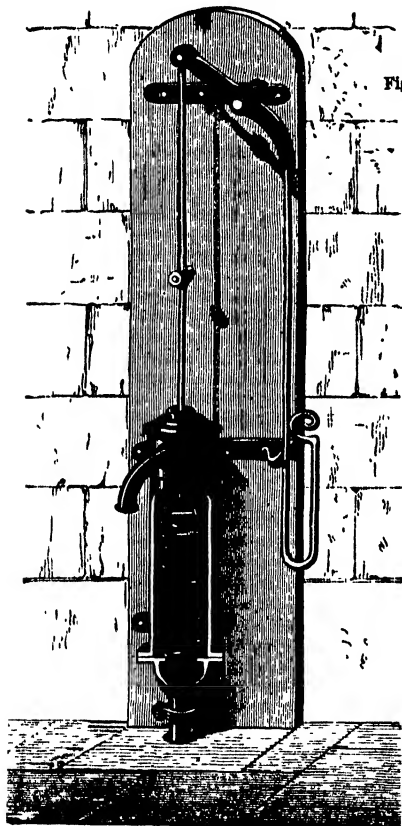
PUMA, or **COUGAR** (*Felis* or *Leopardus concolor*), a species of Carnivora, limited in its distribution to the American continent, and inhabiting Brazil, Paraguay, Guiana, Mexico, and the United States. It has sometimes been termed the 'American Lion,' but it has more the general appearance and conformation of an Old World lioness. Its colour is a uniform fawn or reddish-brown, without spots or markings of any kind. It may attain a length of 9 feet, inclusive of the tail. In habits it is stealthy and cowardly, and seldom or never openly attacks man. At the same time it is much dreaded in its native regions from its insidious mode of attack and from its ravages on domestic animals. The early settlers of the United States lost numerous children and even adults from the attacks of these animals. The Puma appears to kill many victims in a herd of sheep or cattle before it begins to feed. It climbs trees with facility, and is exceedingly lithe and active, making bounds and leaps of considerable extent. This animal appears, notwithstanding its ferocious disposition, to be in some cases susceptible of a high degree of domestication. It is said to become fondly attached to its master; and it is related that Kean the actor thus possessed a puma, named 'Tom,' which followed him like a dog in the most crowded assembly.

The fur of these animals is thick and closely set, and is lightest on the outer aspects of the limbs and on the belly, whilst the breast generally approaches a white colour. The young Puma may show faint stripes on the face and flanks, but these markings totally disappear in the adult. The females are of somewhat smaller size than the male animals.

PUMICE, a variety of felspathic lava found only in volcanic regions. It contains about 60 per cent. of silica, with alumina, iron, lime, soda, &c. It is of a whitish-gray colour; sometimes it is yellow-brown or even black. It is very porous and also fibrous in structure, and its specific gravity is less than that of water, so that it swims in that fluid. Its extreme roughness makes it very useful for polishing; in the solid state it is used to polish wood, paint, &c.; and when pulverized as a polishing powder for glass, bone, ivory, marble, metals, &c. The pumice-stone is supposed to be produced by the action of aqueous vapour or gases on materials melted by volcanic heat. A variety of pumice which presents a less fibrous or tumefied appearance is called *obsidian*.

PUMP, a contrivance for raising liquids or for removing gases from vessels. (See **AIR**, **ATMOSPHERE**, **HYDROSTATICS**.) The operation and the construction of the air-pump are explained in a separate article. There are three kinds of pumps in common use for raising water, of all of which there are various modi-

fications. The simplest and most common pump is the ordinary suction pump. It is of great antiquity, its invention being ascribed to Ctesibius of Alexandria, who flourished about 250 B.C. Fig. 1 shows the most common construction. This pump consists of a hollow metal cylinder, which contains a piston stuffed so as to move up or down in the cylinder easily and yet be air-tight. This piston is pulled and pushed up and down by means of the rods, lever, and handle, shown in the figure. In the piston there is a valve which opens upwards, and at the bottom of the cylinder there is another valve, also opening upwards, which covers the orifice of a tube fixed to the bottom of the cylinder, and reaching to the well from whence



Suction Pump

the water is to be drawn. This tube is commonly called the *suction tube*, and the cylinder the *body* of the pump. At first, when the piston is at the bottom of the cylinder, there can be no air, or at least very little, between it and the bottom valve, for as the piston was pushed down the valve in it would allow the air to escape instead of compressing it. When it is drawn up the pressure of the air shuts the valve, and there is a partial vacuum produced in the body of the cylinder and the suction tube when the piston arrives at the top. But the air in the cylinder and suction tube being very much rarefied, its pressure will be greatly less than that of the external atmosphere on the surface of the water in the well; therefore the water will be pressed up the suction tube. A repetition of the operation causes greater rarefaction of the air, and at length water fills the body of the pump, after which time a volume of water is lifted

at every stroke equal to the size of a cylinder whose base is the sectional area of the pump, and whose height is the play of the piston. During the down stroke the water merely passes through the piston, and is not lifted, and hence this pump is said to be single-acting. Although the height of the piston above the water surface in the well must never exceed 33 feet, the water, after passing through the piston valve, may evidently be lifted to any height we please.

The 'lifting pump', like the suction pump, has two valves and a piston, both opening upwards; but the valve in the cylinder, instead of being placed at the bottom of the cylinder, is placed in the body of it, and at the height where the water is intended to be delivered. The bottom of the pump is thrust into the well a considerable way, and if the piston is supposed to be at the bottom, it is plain that as its valve opens upwards there will be no obstruction to the water rising in the cylinder to its height in the well; for by the principles of hydrostatics water will always endeavour to come to a level. Now when the piston is drawn up its valve will shut, and the water in the cylinder will be lifted up; the valve in the barrel will be opened, and the water will pass through it and cannot return as the valve opens upwards;—another stroke of the piston repeats the same process, and in

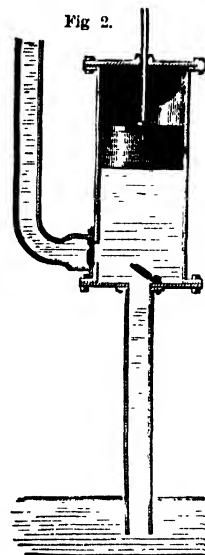
this way the water is raised from the well; but the height to which it may be raised is not in this, as in the suction pump, limited to 32 or 33 feet.

In the 'force pump' the piston has no valve, but there is a valve opening upwards at the top of the suction pipe, and there is another valve at the bottom of the cylinder opening outwards into the pipe which conveys the water from the pump. When the piston is raised, the suction-pipe valve opens, and a partial vacuum being produced, the water is pressed by the atmosphere into the pump on the principle of the suction pump. But when the piston is pressed down the valve of the suction pipe shuts, the valve which leads into the ejection pipe opens, and the water is forced up the tube. When the piston is raised again the ejection valve shuts and the suction valve opens.

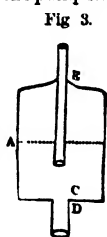
The same process is repeated, and the water is thrown out at every descent of the piston, the discharge therefore is not constant.

It is frequently required that the discharge from the pump should be continuous, and this is effected by

fixing to the top of the eduction pipe an air vessel (fig. 3). This air vessel consists of a box A B, in the bottom of which there is a valve at c opening upwards into the box. This valve covers the top of the eduction pipe D. A tube, E, is fastened into the top of the box, reaching nearly to the bottom of it; it rises out of the box, and is furnished with a stop-cock. If the stop-cock be shut, and the water be sent by the action of the pump into the air vessel, it cannot return, in consequence of the shutting of the valve c; and because of the space occupied by the



Force Pump.



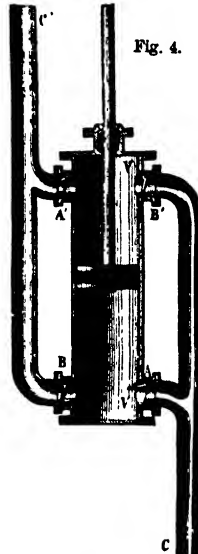
water the air in the box is compressed, and will therefore exert a pressure on the water in the air vessel. If the water fill three-fourths of the box, then the air will be compressed so as to exert four times the pressure that it did while the box or air vessel remained empty of water, and will, therefore, according to the law of Mariotte, force the water up the tube *E*, and the result will be that a continuous jet will issue from the upper orifice of that tube.

The fire-engine (which see) consists of two forcing pumps, working into one common air vessel placed between them, and from which the spouting pipe for directing the water proceeds. 'Double-acting' pumps are often employed for household purposes. They consist of a pump barrel *v v* (fig. 4), with four openings in it, *A A' B B'*. The openings *A* and *B'* are in communication with the suction tube *C*; *A'* and *B* are in communication with the ejection tube *C'*. The four openings are fitted with four valves opening all in the same direction, that is from right to left, whence it follows that *A* and *B'* act as suction valves, and *A'* and *B* as ejection valves, and consequently in whatever direction the piston may be moving the suction and ejection of water are taking place at the same time. The chain pump sometimes used is an upright barrel, through which leathers strung on a chain are drawn by means of wheels or drums, in constant succession, carrying the water in a continual stream before them. They are employed only when a large quantity of water is to be raised, and must be worked rapidly.

Centrifugal pumps are now commonly employed wherever the lift is not too great and the quantity of water is considerable. The principle of their action is that when a mass of matter is set in rotation its particles tend to fly off from the centre of rotation. A wheel, shaped like an ordinary fan, has passages leading from its centre to its circumference; it is made to rotate very rapidly in a casing; its circumference communicates with a delivery pipe, and its centre with a pipe leading to the water which is to be pumped. There is a constant flow from centre to circumference of the wheel, the water from the well is sucked up to the centre of the wheel, and leaves the circumference by the eduction pipe. See Colyer's Pumps and Pumping Machinery (1887); Bjorling's Pumps (1892); and Barr's Pumping Machinery (1893).

PUMPERNICKEL, the name given to a coarse brown bread made in Westphalia (more especially in the districts of Münster and Osnabrück) from unbolted rye. It is baked in large square loaves, which often weigh as much as 60 lbs. Its proper manufacture depends upon the treatment of the dough, which must contain neither yeast nor leaven, and also on the management of the oven, in which the batch must remain from twelve to fourteen hours.

PUMPKIN, or **POMPION** (*Cucurbita Pepo*), a species of gourd, or squash, distinguished from most varieties of the latter by the rounded form of the fruit, which sometimes grows to an enormous size.



Double-action Pump.

It has hispid, branching, and prostrate stems, which in good soil will cover an eighth part of an acre. The fruit is esteemed inferior to most varieties of the squash, but, notwithstanding, it is very commonly cultivated, both in Europe and America.

PUN, a play upon words, the wit of which depends on a resemblance between two words of different and perhaps contrary significations, or on the use of the same word in different senses; as in the well-known story of the man who, being requested to make a pun, asked for a subject, and was told to take the king, upon which he replied that the king was no subject. The Greeks and Romans sometimes used puns even in serious discourses; but the moderns restrict them to light conversation, devices, symbols, rebuses, mottoes, &c.

PUNCH, an intoxicating beverage much more used formerly than in the present day. The various ingredients of which it is composed are spirits, water, lemon-juice, and sugar, with occasionally an addition of some spice, as nutmeg or cinnamon. These are usually mixed in the requisite proportions in a large china bowl made for the purpose—hence called the punch-bowl. The most usual form of the beverage is compounded as follows:—Squeeze the juice out of three or four lemons into a jug, adding thereto the peel of one lemon cut in slices, 12 ozs. of lump-sugar, and 3½ pints of boiling water; infuse this mixture for half an hour, then pour into the punch-bowl, and add of rum and brandy rather less than a pint of each. Varieties of punch are called after one of their principal ingredients, gin, milk, orange, raspberry, tea, wine, &c. Punch was introduced into Great Britain from India, and it appears to be so called from the Hindu *panch*, five, which is the usual number of the ingredients.

PUNCH, a tool used for making holes in wood, malleable metal, or other materials, by cutting out the piece; and it is thus distinguished from the drill. It cannot be applied to cast-iron or bronze, being in that case liable to break or produce a ragged edge. Besides the various hand punches there are several machines adapted for punching. One type of machine consists of a strong frame, at the front of which is a broad slide, moved vertically up and down by an eccentric fixed on the end of a shaft passing lengthwise through the frame; on this shaft there is a large wheel, which receives motion from a pinion on another shaft carrying the fly-wheel and driving-pulleys. The punches are fixed in the lower end of the vertical sliding-piece, and immediately under them is fixed a piece of steel called the dies, which has holes in it to correspond to the punches. The plate in which holes are to be punched is fastened upon a travelling table in front of the machine; and the slide being up, and the surface of the table level with that of the dies, the part where the holes are to be punched is placed between the punches and the dies, so that when the machine is set in motion the punches are forced through the plate by the action of the eccentric, and the pieces driven out fall through the holes in the dies.

PUNCH AND JUDY, a well-known puppet-show frequently exhibited in the streets. The show of 'Punch and Judy' derives its origin from the Neapolitan *Punchinello*, but many of its features are purely English. (See *PUNCHINELLO*.) The earliest account of the adventures of Punch and his wife Judy is found in a ballad the date of which does not appear to be anterior to 1795. This account corresponds pretty closely with the representations given in our streets. The show embodies a domestic tragedy, followed by a supernatural retribution, the whole of which is treated in a broadly farcical manner. Punch himself is represented as short and thick-set, with an

immense hump upon his back, a wide mouth, long chin, and hooked nose, and wearing a three-pointed cap. His wife Judy, who is in some respects his counterpart, and his dog Toby, are important characters in the performance.

PUNCHEON, a liquid measure of capacity containing one-third of a tun, or 84 gallons.

PUNCHINELLO (from *pulcinello*), an Italian mask. The Abbate Galiani derives the name from a misshapen but humorous peasant from Sorento, who had received it (about the middle of the seventeenth century) from his bringing chickens (*pulcinelle*) to market in Naples, and who, after his death, was personated in the puppet-shows of the San Carlino theatre, for the amusement of the people, to whom he was well-known. According to another account, a company of actors, which went to Acerra at the time of the vintage, was attacked by the peasants (with whom the vintage is a season of festivity) with a sally of jokes and gibes, in which a certain Puccio d'Aniello among the peasants attracted notice by his comical humour and grotesque appearance, being hunched before and behind. The players had to yield to him; and when the contest was over they determined to take advantage of the talent of Puccio d'Aniello, and persuaded him to join their company. He appeared on the stage in a white robe, and large, full shirt, with long hair, and soon became such a favourite of the Neapolitans that his mask was retained after his death; and his successor, to resemble him the more, chose a mask with a long black nose. From his name was formed, according to Neapolitan custom, *Pulcinello*. Perhaps, however, this mask was only a modification of an older one, which some have derived from the ancient *Atellane fabulae* (which see), and have thought that they discovered the grotesque figure of Punch on ancient vases. This mask is still the delight of the Neapolitans.

PUNCTUATION, the art of employing certain signs, by means of which the parts of a discourse are connected or separated, as the sense requires, and the elevation, depression, or suspension of the voice indicated. Punctuation serves both to render the meaning intelligible, and to aid the oral delivery. A fully developed system of punctuation is peculiar to the modern languages of Europe. The Romans were, indeed, acquainted with the term, but with them it had a totally different signification. Their points, as well as those of the Greeks, were almost entirely oratorical, that is, confined to the delivery and pronunciation of the words; and there were often no points, or at most only one at the end of a sentence, or pauses were indicated by breaking up the matter into lines or paragraphs (*stichoi*). Modern punctuation, which is, for the most part, grammatical, is of a later origin, and the invention has been attributed to the Alexandrian grammarian Aristophanes, who flourished in the second century, after whom it was improved by succeeding grammarians. But as no particular rules were followed in the use of these signs, punctuation was exceedingly uncertain until the end of the fifteenth century, when the learned Venetian printers, the Manutii, increased the number of the signs, and established some fixed rules for their application. These were so generally adopted that we may consider them as the inventors of the present method of punctuation; and although modern grammarians have introduced some improvements, nothing but some particular rules have been added since that time. The principal points used in English composition are the comma (,), semicolon (;), colon (:), period or full stop (.), note of interrogation (?), note of exclamation or admiration (!), dash (—), and parenthesis (). Of these the first four are grammatical points indicating the length and

character of the pauses to be made in reading; the others are mainly rhetorical or syntactical aids regulating the modulation of the voice rather than its suspension, but the notes of interrogation or admiration may take the place of any point of the former class, according to the structure of the sentence, and the dash partakes of both characteristics. No rules for punctuation can be laid down that will meet every case, the structure of sentences being so various. In general it may be said that the comma marks the smallest grammatical division in a sentence, separating the several members of a series, also the subordinate clauses from the main clause, and the like. The semicolon indicates a longer pause than the comma, but requires another member or members to complete the sense. The colon denotes a still longer pause, and may be inserted when a member of a sentence is complete in itself, but is followed by some additional remark or illustration of the subject. The period indicates the end of an assertive sentence, and is also used after contracted words, after headings, titles of books, &c., and generally after Roman numerals. The note of interrogation is placed at the end of an interrogatory sentence: the Spanish place it before as well as after such a sentence. The note of exclamation or admiration is placed at the end of such words or clauses as indicate strong emotion. The dash is employed where a sentence breaks off abruptly and the subject is changed; where the sense is suspended, and is continued after a short interruption; where there is an unexpected or epigrammatic turn in the sentiment; after a series of clauses leading to an important conclusion; and in certain cases to indicate an ellipsis. The parenthesis incloses a word or phrase introduced into the body of a sentence, with which it has no grammatical connection. These points do not indicate all the pauses to be taken in reading. There are many cases in which a pause should be made where there is no point, but the consideration of this subject belongs to elocution.

PUNDIT. See **PANDIT**.

PUNIC (from *Pœni*, Phœnicians), an epithet originally synonymous with *Phœnician*, but in classic usage equivalent to Carthaginian, Carthage being a Phœnician colony.—*Punic wars*, wars waged between Rome and Carthage. The first of these wars broke out in B.C. 264, and was not brought to a termination till B.C. 241; the second lasted from B.C. 218 to B.C. 202; and the third, which ended with the destruction of Carthage, from B.C. 149 to B.C. 147. (See our articles on **ROME**, **CARTHAGE**, **HANNIBAL**).—*Punic faith* (*fides Punica*), among the Romans a proverbial expression for faithlessness.

PUNISHMENT, a term derived, through the French *punir*, from the Latin *punire*, which is connected with *pœna*, satisfaction, compensation. Originally it signified pain inflicted on or endured by a person as a satisfaction or atonement by him for some offence which he had committed; it embodied, in fact, the idea of retaliation, and this appears to have been the earliest notion of punishment which most nations of which we have any record possessed. It occurs amongst the early Greeks; the Romans recognized it in the laws of the Twelve Tables; and it was the principle of the well-known provision of the Mosaic law, 'an eye for an eye,' &c. (Exod. xxi. 24). This view of punishment, however, which makes it merely equivalent to vengeance, has been superseded among Christian nations by one which accords better with the spirit of Christianity, which is that the proper end of punishment is not so much to avenge past, as to prevent future offences. In this country punishment by death is called *capital* punishment; other modes of punishment are called *secondary*. The latter vary in severity according to the estimated

magnitude of the offence. The crimes for which capital punishment is now inflicted in England have been reduced to two—namely, murder and high treason. Up to a comparatively recent period, however, crimes entailing capital punishment were numerous, including, for instance, attempts to murder, accompanied with actual injury to the person; the burning of buildings or ships, with danger to human life and under defined circumstances; piracy, accompanied with acts endangering life; burglary, aggravated by cruelty or violence to an inmate of the house; robbery, aggravated by personal violence; &c. Sentence of death may be commuted by the sovereign into penal servitude for life. Secondary punishments are of two kinds, imprisonment with or without hard labour, and the infliction of fines. See CAPITAL PUNISHMENT, CRIMINAL LAW, PRISON, &c.

PUNJAB, or PANJAB (the '*Five Waters*'), an extensive territory in the north-west of Hindustan, formerly under the dominion of the Sikhs, but in 1849 attached to the Presidency of Bengal. It is so called from its position, being intersected by the Indus and the four great rivers which unite to pour their waters into it. There are in reality five rivers besides the Indus, but the Bias, being much smaller than the others, seems to have been neglected when the name was given. Some authorities, however, leave out the Indus as one of the five, and take in the Bias instead. In 1901 the north-western part of the Punjab was separated to form a chief commissionership under the government of India (see NORTH-WEST FRONTIER PROVINCE). The lieutenant-governorship as thus limited is bounded on the east by Kashmir, Tibet, and the river Jamma, which separates it from the North-West Provinces; on the south by Sind and Rajputana, the river Satlej being in part a boundary river; on the west by Baluchistan and the new province; and on the north by the new province. For administrative purposes it is divided into nine divisions (Delhi, Ambala, Hissar, Jalandhar, Lahore, Multan, Amritsar, Rawalpindi, and Derajat), comprising twenty-eight districts. Lahore is the capital, but Delhi is the largest town. Before the separation of the North-West Frontier Province the total area was (excluding native states) 110,667 square miles, now it is 97,920 square miles. The area of the native states is 38,239 square miles. The population of the unredueed province was in 1891, 20,866,847; in 1901, 22,449,481. The population on the present area of the province in 1891 was 19,984,984. The native states contained 4,263,280 inhabitants in 1891, 4,438,816 in 1901.

General Description.—By the separation of the very mountainous region of the extreme north the province has become more uniform in its physical character. Though there are important mountain ranges in Rawalpindi and neighbouring districts, the surface is for the most part an extensive plain, gradually sloping from the north-east to the south-west, in the direction of the six rivers by which it is so abundantly irrigated. These rivers (proceeding from west to east) are the Indus, the Jhilam (ancient *Hydaspes*), Chenab (ancient *Acceines*), the Ravi (ancient *Hydraotes*), the Bias (ancient *Hyphasis*), and the Satlej (ancient *Hesudrus*). The Jhilam and Chenab unite their waters, and then are joined by the Ravi; the united stream is then augmented by the Satlej, which has previously received the Bias. The combined waters of these rivers form the Panjnad, which joins the Indus near Mithankot. The rivers of the Punjab divide it into five districts, or *doabs* (countries between two rivers), namely, the Sind-Sagar Doab, between the Indus and Jhilam; the Jech Doab, between the Jhilam and Chenab; the

Rechna Doab, between the Chenab and Ravi; the Bari or Manja Doab, between the Ravi and Bias; and the Jallander Doab, between the Bias and Satlej. Of these the first is by far the largest, but also the most sterile and least inhabited, abounding with bare eminences and rugged declivities, interspersed here and there with rich and fertile valleys. The second doab is mostly level, and has been described as 'a sterile waste of underwood', the abode of shepherds, and scantily irrigated; the Rechna Doab is bare and neglected, though susceptible of high cultivation; the Bari Doab, though bare, has a large surface under cultivation, and is the most populous and important of all, containing the large towns of Amritsar, Multan, and Lahore; while the Jallander Doab is highly cultivated, well peopled, and excelled in climate and productions by no province in India. Speaking generally, the plains east of the meridian of Lahore, 'include all the most fertile, wealthy, and populous portions of the province, and may be called the granary of the Punjab'; while those on the west present a striking contrast. The soil of the level country varies remarkably from stiff clay and loam to sand, mixed with each other in variable proportions, and with vegetable matter; besides which, carbonate and sulphate of soda are sometimes mixed with it in such quantities as to render the land almost worthless. The mineral wealth of the Punjab is almost confined to its rich deposits of rock-salt. The climate is hot and dry, and little rain falls, except in the higher country and under the influence of the south-west monsoon. The part of the province to the east of Lahore can be cultivated in most seasons without irrigation, but owing to this its crops are much more likely to fail from a deficiency of rainfall than those of the western irrigated tracts. The summer heat is very great, and in the early part of January sharp frosts are common.

Vegetation, Agriculture.—The indigenous vegetation of the Punjab bears a close resemblance to that in the plain of the Ganges. Wood is scarce, except upon the hills, but tree-planting has been encouraged for some time by the government. In the west considerable areas are occupied by date-trees; and palms of other species, banyans, and other trees are found here and there. The area under forests is over four and a quarter million acres. About 28,000,000 acres of the remainder are under cultivation, and over 20,000,000 acres more are available for cultivation. The principal grain crops are wheat and barley, of excellent quality, rice, buckwheat and millet, pease, vetches, and mustard; sesamum, and other oil seeds are extensively grown. Turnips, carrots, onions, cucumbers, and melons are raised in large quantities. The crops also include indigo and sugar, and both articles are exported. The tobacco plant also grows luxuriantly, especially about Multan, and opium has been grown pretty extensively. About seven and three-quarter million acres are under wheat, and over 750,000 under rice. The total irrigated area exceeds 9,000,000 acres, of which more than half is irrigated by canals. Among the fruits are the date, orange, fig, vine, apple, mulberry, banana, and mango; but these occur only in a cultivated state and near the towns. The live stock include sheep, cattle, horses, and camels. The breeding of horses and cattle is an important industry. Buffaloes are common.

People.—The population of the Punjab is composed of various races, the chief of which are the Jats, Rajputs, and Pathans. The Jats form the bulk of the agricultural peasantry, and are described as tall and athletic, with handsome, open countenances, long beards, and fine teeth. The Rajputs and Pathans are also generally of handsome appearance,

the latter being allied in race to the Afghans. The people, indeed, generally, are in physical respects superior to those of Bengal, having stout, well-rounded limbs, and an active, graceful carriage, particularly the better classes. The women, too, are elegantly shaped and very attractive; their costume embraces trousers and extraordinarily high conical caps. The common male attire consists of a *pagri* or sort of turban, a close-fitting jacket, and large bulky trousers usually terminating at the knee, with a scarf thrown over the shoulder, either with a coloured trimmed border or consisting of a gaudy-coloured shawl; the rest of the dress is invariably white, and kept for the most part very clean. The hair is worn long, and gathered up into a knot at the crown.

Religion.—By the census of 1891 the distribution of the population according to religious profession was as follows:—12,915,643 Mohammedans, 10,237,700 Hindus, 1,870,481 Sikhs, 53,909 Christians, 45,683 Jains, 8236 Buddhists, 412 Parsis, 33 Jews, and 30 others. Of the Christian population 27,915 belonged to the Church of England, 12,083 were Presbyterians, 7113 were Roman Catholics, the remainder being Baptist, Lutheran, &c. The Mohammedans form a very large part of the population of the Derajat, Rawalpindi, and Multan divisions. The Hindus predominate in the easterly divisions of Hissar and Delhi, and in the mountainous district of Kangra. The Sikhs, though less numerous than the Mohammedans and the Hindus, are in several respects more important. They reside chiefly in the centre and east of the province, especially in the districts of Amritsar, Jallandar, Lahore, Ludhiana, and Ferozpur, and in these parts they constitute the mass of the gentry. The few Buddhists of the Punjab are almost entirely confined to the small Spiti district in the extreme north-east. The Pathans, Shaikhs, and Baluchis are the most numerous of the Punjab Mohammedans by race, but the Mohammedan strength consists largely in converted Hindus belonging to the Jat and Rajput tribes. The Hindu Jats form a large proportion of the population. (See SIKHISM.)

Language and Education.—The chief languages spoken in the Punjab are Punjabi, Hindi (Braj Bush dialect in the east), Sindhi (in the south-west), Jataki, Kashmiri, Pushtu, Persian, and English. Since the country came under British rule elementary education has received much attention. The total number of educational institutions in the Punjab in 1899–1900 was 7867, with a total of 262,319 scholars. Of these 2145 with 129,037 scholars were public institutions under public management, 919 with 57,722 scholars were public institutions under private management, and 4803 with 75,560 scholars were private institutions. Of the public institutions 11 were for university education, 383 were secondary schools, 2647 were primary schools, 6 were training-colleges, and the other 16 special schools of various kinds. The number of scholars in primary public schools was 115,620, of whom only 11,271 were girls. Of the higher educational institutions of the province the following may be mentioned:—the Punjab University at Lahore; Lahore Government College; Oriental College; St. Stephen's College, Delhi; Lahore Medical School; St. Thomas College, Murree; the Khalsa College, Amritsar; Bishop Cotton School; Simla; and the Lawrence Military Asylum, Sanawar.

Manufactures and Trade.—The manufacturing industry of the Punjab is carried on on a somewhat extensive and important scale, though it is chiefly confined to the larger towns. Amritsar, Lahore, Multan, and Shujabad are distinguished for their silk and cotton fabrics; and the silks of Multan,

called *kais*, and chiefly used for scarfs, possess a strength of texture and brilliancy of colour for which they are much prized in the Indian markets. The shawls of Lahore, too, rank only second to those of Kashmir. Brocades, tissues, and carpets resembling the Persian are also manufactured in the capital. In the east of the Punjab, about Rohun and Hoshiarpur, white cotton goods are prepared of a stronger and more durable texture, as well as cheaper, than those of British manufacture. Swords and firearms of all sorts and of an excellent quality were under the Sikh dynasty made in great quantities at Lahore.

The Punjab enjoys from its position an extensive transit-trade with Cabul, Bokhara, Kandahar, &c., as well as a more direct one for the disposal of its produce and the supply of its internal wants. The imports comprise sugar, spices, and other groceries, dye-stuffs and cottons, woollen and silk fabrics, metals and metallic utensils, cutlery, precious stones, ivory, glass and cochineal, asafoetida, safflower, fresh and dried fruits, wool, horses, &c. The exports—partly of home produce, partly in transit—comprise grain, *ghee*, hides, wool, silk and cotton fabrics, carpets and shawls, raw silk and cotton, indigo, tobacco, hardware, horses, &c. The trade of the Punjab is facilitated by upwards of 2600 miles of navigable rivers and 26,000 miles of roads, besides railways and canals. But water communication is now of comparatively little importance.

Government and Revenue.—The government under the Sikhs originally consisted of a sort of republic, or federation of *sirdars* or chiefs, all holding independent sway and administering the laws in their own districts; but these at length, through the rising power of Runjit Singh, became subordinate to the Maharajah, under whom they became feudal chiefs, paying him an allotted portion of the tax or tribute collected within the respective districts. As a usual rule the produce of the land was equally divided between the chief and the farmer, the impost for grain being paid in kind—that for sugarcanes, melons, &c., in cash. The chief, however, never levied to the full extent; and in no country, perhaps, was the *ryot*, or cultivator, treated with more indulgence. Commerce, on the other hand, was not a little impeded by the heavy duties levied on goods by the sirdars of the districts through which they passed; and owing to this circumstance, as well as to the long-disturbed state of the Punjab, much of the trade from Hindustan to Cabul and Turkestan was carried by other and longer routes. The government under the British rule resembles that already so long existing in the other parts of India, and the revenues are gathered on a similar system. The province is under a lieutenant-governor, assisted since 1897 by a legislative council of nine members. (See INDIA—Revenue and Expenditure.) The most important item of revenue is the land-tax, which, on the average, yields a net revenue, after deducting charges, of nearly £2,000,000. The revenue is also partly derived from excise duties on spirits and drugs, duties on stamps, &c. The financial condition is so favourable that there is often a clear surplus of revenue over expenditure of £2,500,000. About one-half of the whole cultivated area of the Punjab is tilled by owners, and about one per cent by tenants paying a nominal or no rent. Of the remaining area one-fifth is cultivated by occupancy tenants, and the rest is held by tenants-at-will. The number of tenancies of the last-mentioned kind is increasing from year to year. Rents vary from 5 annas to 40 rupees per acre, the average being about 2½ rupees. On about two-thirds of the land held by tenants-at-will the rent

is wholly or partly paid in kind, and the average rent payable in kind is for the whole province about two-fifths of the produce. Nearly five million acres are under mortgage.

Army and Police.—The Punjab forms a military district under a lieutenant-general. The military force stationed in the Punjab in 1900 consisted altogether of 68,806 men. Of cavalry there were 11,893, of infantry 50,504, of artillery 6120, with some engineers, &c. There were thus more troops in the Punjab than in any other division of India. The police force is stated to be in a most effective condition. It numbers about 20,000 men, divided into two divisions, the Trans-Satlej and the Cis-Satlej. Almost all the police are armed either with swords or guns. The Punjab has a chief court with five judges.

History.—The Punjab plays an important part in the history of Hindustan and British India. It was invaded in 327 B.C. by Alexander the Great, who defeated Porus at Mong in Gujerat and overran the whole country. In 1022 it was overrun by the troops of Mahmud of Ghazni, whose successors held the country for 170 years, making Lahore the seat of their government. In 1193 it passed by conquest into the hands of Mohammed Ghorri, and Delhi became the capital. After his death the country was ruled by a succession of turbulent chiefs, principally Afghans, till at length in 1526 Baber, the founder of the Mogul Empire, having obtained possession of the country, ascended the throne, and established a dynasty whose sway prevailed for about two centuries, during which the Sikhs were rising into importance. In 1738 Nadir Shah overran the Punjab, and in the following year he defeated the Mogul army at Karnal and sacked Delhi. The Sikhs, who had several times risen against their Mohammedan rulers, were utterly defeated by the Afghan conqueror Ahmed Shah Durani in 1762, and the Moguls nominally ceded the Punjab to that monarch. The Duranian dynasty maintained its ascendancy till the beginning of the nineteenth century, when the Sikhs under Ranjit Singh began their career of conquest. In 1818 this renowned chieftain stormed Multan and took Peshawar—in the following year conquering Kashmir and Derajat west of the Indus; and in ten years he succeeded in establishing his power over the whole country of the five rivers, to which were afterwards added, by the conquests of his vassal Gholab Singh, Ladakh, and Balistan. His right to all the territories he thus possessed on both sides of the Indus was formally acknowledged by the British government in 1838, and in 1839 Ranjit Singh died, having amassed, by war and plunder, no less than £10,000,000 sterling of treasure and movable property, and leaving the country in a state of exhaustion and disorder. His son Khorak Singh quietly succeeded, but died of a decline a few months after his father, on which Shere Singh, a natural son of the great Ranjit, assumed the sovereignty, but was assassinated, 15th September, 1843. Dhulip Singh, a minor, the son of the former maharajah, Khorak Singh, succeeded without opposition, having Herra Singh, the nephew of Gholab, for his viceroy or prime minister, but intrigues and civil disturbances now from time to time distracted the country, and from the close of 1843 to the period of its annexation to British India the government was in abeyance, or, what is worse, in the hands of an ignorant, bloodthirsty, rapacious, and insubordinate army. At length it became manifest that the Sikhs of the Punjab were preparing for an irruption into the territories protected by the British on the east of the Satlej. In the end of December, 1845, the Sikh forces passed the Satlej into the territories protected by the British, with a most formidable

train of artillery, but they found themselves completely worsted after the hard-fought actions of Mudki, Ferozeshah, Aliwal, and Sohraon. Lahore and other stations were afterwards occupied by British troops; the Jallandar Doab, between the Satlej and Bias, was permanently ceded to the British; and the province of Kashmir, and the other provinces of the Himalayas, were vested in the Rajah Gholab Singh. In 1849 a conspiracy between several disaffected chiefs and the Afghans resulted in further hostilities against the British, Multan being the centre of their operations. The indecisive battle of Chillianwalla was followed by the capture of Multan in January, and the victory of Gujerat in February, 1849, since which period the former territories of the Maharajah Dhulip Singh have formed an integral part of the British Empire in the East. The most important subsequent event in the history of the province was the Indian Mutiny. After the suppression of the mutiny the province was erected into a lieutenant-governorship. Famine and the plague have caused many deaths in the Punjab as well as in other parts of India during recent years. The separation of the North-West Frontier Province in 1901 has been noticed above.

PUNKAH, an immense fan used in India and other hot countries for ventilating rooms. It consists of a movable frame of wood covered with canvas and suspended from the ceiling. It is pulled backwards and forwards by means of a cord, and thus causes a current of air in the apartment.

PUNO, a town of Peru, capital of the department of the same name, on the west shore of Lake Titicaca, 12,870 feet above sea-level, and 90 miles east by south of Arequipa. It consists of two portions, both of cheerful appearance, and with straight, well-paved streets, and has two churches, a college, and an hospital. A railway runs to Arequipa and to Mollendo on the Pacific. Pop. 6000.—The department grows potatoes and barley, but is particularly distinguished by the extent and richness of its pastures. Its principal exports are the wool of the sheep, llama, alpaca, and vicuña, and some cascarilla bark from the valley of Carabaya. Pop. (1896), 537,345.

PUNT, an oblong flat-bottomed boat used for fishing and shooting in shallow waters; it is also used in caulking and repairing ships. The most common mode of propulsion is by pushing with a pole against the bottom of the river, &c., a process which is hence called punting.

PUPA, the name applied to the second stage in the metamorphosis of insects. This stage has also been named the *nymph* (which see) or *chrysalis* period of development. In the typical Complete or Holometabolic Insects, exemplified by Beetles, Butterflies, Flies, &c., the pupa stage is marked by quiescence and rest, and thus presents a contrast to the preceding and active larval stage. The pupa may be inclosed within a case or *cocoon*, as in Butterflies and Moths, or may simply remain quiescent within the hardened larval skin, which thus serves as a pupa-case. During the pupa stage the elements of the larval form are being remodelled into that of the *imago* or perfect insect, which in due time emerges from the pupa case. The time in which an insect may remain in the pupa stage varies very greatly throughout the different groups of insects, and may extend from a few hours or days to weeks, months, or even years.

The pupæ of the Hemimetabolic Insects, or those which undergo an incomplete metamorphosis (such as Grasshoppers, Locusts, Bugs, &c.), are active and freely moving, and differ from the perfect insect, which they resemble in form, chiefly in the absence or rudimentary nature of the wings. These latter

structures in the pupa state of Hemimetabolous insects may generally be perceived to be in course of formation, the perfect insect or imago state being characterized simply by the full development of the wings. See also ENTOMOLOGY, INSECTA, NYMPH, METAMORPHOSIS.

PUPIL. See EYE.

PUPPET-SHOWS. One of the most common classes of puppets are called, in French, *marionnettes* (from *marion*, fool, buffoon, as Frisch supposes). These are images of the human figure moved by wires or threads on a stage, and made to perform little dramas, the dialogue of which is carried on by the person in concealment, who moves the figures. In the common street performance of Punch and Judy, however, the performer puts his fingers in the figures. Puppet-shows were common among the Greeks (who called them *neurospasta*), from whom the Romans received them. Xenophon, Aristotle, Gellius, Horace, and others mention them. Such exhibitions, which are so pleasing to children and the uneducated, naturally passed through various degrees of perfection in different ages, and even now exhibitions of puppets are common in some countries which display great mechanical ingenuity, while the poor hand-organ boy in the street still turns his instrument, and gives to one or two figures on a board before him a few simple motions with his foot. Clocks for the peasants often display movable puppets, and it is not unfrequent in Germany to find on ancient town clocks puppets which move whenever the clock strikes. In 1674 there was a puppet opera at Paris, which met with great applause. At present there are two theatres in Paris for puppet-shows, and they still continue to be performed in several large cities of Italy. In Germany, also, excellent puppet-shows are sometimes seen, but they are there hardly ever stationary, and are not by any means so much patronized as in Italy.

PURANAS. See SANSKRIT LANGUAGE AND LITERATURE.

PURBECK, ISLE OF, a district in England, forming the south-east angle of Dorsetshire, and consisting of a peninsula surrounded by the sea on the south and east, and so separated from the mainland on the north by Poole harbour and the Frome, and on the north-west by a rivulet called Luckford Lake, as to be connected with it by only a very narrow isthmus. It is about 12 miles long by 7 miles broad; is traversed from west to east by a chalky ridge dividing it into two parts—a northern, covered chiefly with heath, and a southern, which is generally fertile. The prevailing rock is limestone, one kind of which, being susceptible of a good polish, takes the name of Purbeck marble. Numerous quarries of this and of the more abundant building stone are worked.

PURBECK BEDS. See GEOLOGY.

PURCELL, HENRY, an eminent English musical composer, was the son of a musician of the chapel-royal, who, dying in 1664, left him an orphan in his sixth year. He was admitted at an early age a chorister in the king's chapel, where he studied music under choir-master Cook and his successor Pelham Humphrey, and afterwards under Dr. Blow. In 1676, when only eighteen years old, he was made organist of Westminster Abbey, and six years afterwards was appointed to fill the same office at the chapel-royal, St. James'. From this period his fame seems to have increased rapidly, his anthems and church music in general being popular in all the cathedrals of the kingdom; nor were his compositions for the stage and music-rooms less successful. His genius embraced every species of composition with equal facility; and with respect to chamber music, all prior productions seem to have been at once totally superseded. Of his numerous compositions his celebrated

Te Deum and *Jubilate* appear to have been composed for the celebration of St. Cecilia's Day, 1694. Of his instrumental music a collection was published two years after his decease, containing airs in four parts, for two violins, tenor and bass. Many of his songs were published after his death under the title of *Orpheus Britannicus*. *Ye Twice Ten Hundred Deities*, contained in this collection, is considered the finest piece of recitative in the language; while his music in *King Arthur* has maintained its popularity undiminished till our own day. In 1695, the year of his death, he set to music *Bonduca*, an opera altered by Dryden from Beaumont and Fletcher; but his chief opera is *Dido and Æneas* (1680). He was the author of a vast variety of catches, rounds, glees, &c., remarkable both for their melody and for their spirit, humour, and originality. Purcell died 21st Nov. 1695, and was buried in Westminster Abbey. A splendid edition of his works is being published by the Purcell Society, founded in 1878. Novello's edition of his sacred works (1829-32) deserves mention. See the *Life* by Cummings (1882).

PURCHAS, SAMUEL, an English divine, was born in 1577, at Thaxted, in Essex, and educated at Cambridge. In 1613 he published an important work entitled *Purchas his Pilgrimage, or Relations of the World and the Religions observed in all Ages and Places*. The fourth edition of this work, published in 1626, contains numerous important additions, and is generally sold as the fifth volume of his second great work, namely Hakluyt's *Posthumus*, or *Purchas his Pilgrimes*, published in four vols. folio, in 1625. These works, with Hakluyt's *Voyages*, led the way to other collections of the same kind, and have been much valued and esteemed. The difference between the two books is that the first is a compilation in Purchas's own language, whereas the second is a collection of narratives written by various authors, supplemented and edited by Purchas. The whole five volumes are generally known as *Purchas's Pilgrima*. He also wrote *Microcosmos, or the History of Man*, a *Series of Meditations on Man at all Ages and in all Stations* (8vo), the *King's Tower and Triumphal Arch of London*, a sermon. Purchas was rector of St. Martin's in Ludgate, and chaplain to Abbot, archbishop of Canterbury, and was highly esteemed for his learning and piety. He died in London in 1626.

PURCHASE, in law, the acquiring of land with money, by deed or agreement, and not by descent or right of inheritance. *Purchase* is also a name given to any sort of mechanical power employed in raising or removing heavy bodies.

PURCHASE IN THE ARMY, a system, now abolished, by which more than half the first appointments and subsequent promotion of officers used to be effected. The prices of commissions were fixed as follows:—£450 for a cornetcy or ensigncy; £700 for a lieutenancy; £1800 for a captaincy; £3200 for a majority; and £4500 for a lieutenant-colonelcy, which was the highest rank that could be obtained by purchase. An officer wishing to retire from the service might sell his commission for the price affixed to the rank he occupied. When a superior officer 'sold out' the next officer inferior to him might purchase promotion to the rank of the former by merely paying the difference between the prices of their respective commissions. The rank of the second might be reached in the same manner by his next inferior, and so on down to the ensign. No commission could be purchased by one officer unless another officer vacated his commission by its sale. The regulation prices were not, however, always adhered to, nor the method here specified followed; and in this way complications arose which frequently occasioned no small difficulties in the carrying out of the system.

The system of purchase dates from the first formation of a standing army. An act was passed in 1552, under the reign of Edward VI., prohibiting the sale of commissions; in 1683 a royal warrant ordained the payment of 1s. in the pound on the surrender of a commission, but a few years subsequently all payments were interdicted. The purchase of commissions was legalized in 1702, various restrictions being afterwards imposed. The practice of selling commissions above regulation prices having become very prevalent, two commissions of inquiry—one in 1725 and another in 1765—were appointed to report on the matter, and in 1809 over-regulation prices were made penal. From 1840 to 1870 no fewer than eight royal commissions were appointed in connection with the purchase system, and on July 20th, 1871, this system was abolished by royal warrant. By the Regulation of the Forces Act, passed in the latter year, it is provided that every officer holding a saleable commission in the army on Nov. 1, 1871, shall be entitled to compensation in respect of such commission. The system of payments was to extend over twenty-five years, and it was calculated that about £8,000,000 would be required. An officer is still permitted to receive money for exchanging his commission with another of equal rank.

PURGATIVES are medicines used for the purpose of producing the evacuation of the bowels. These medicines may act in three different ways on the alimentary canal: first, by stimulating the muscular fibres of the intestines, whence their peristaltic motion is augmented, and the contents of the bowels quickly and completely discharged. This kind of action is of the greatest importance in many forms of fever, and may be produced by preparations of jalap, senna, &c., in combination with calomel, and such auxiliaries as manna and other mild laxatives. Secondly, they may act by promoting or bringing about a drain of water from the blood-vessels of the intestinal wall. Saline purgatives, such as the seidlitz and sodaic powders, the acetate of potash, sulphate of magnesia, and many vegetable purgatives, of which elaterium is the most powerful, come under this head; and they are extremely useful in inflammatory fever, dropsy, and other diseases of this kind. The third kind of action is the augmentation of the biliary and pancreatic secretions. This is effectually done by mercurials combined with drastic, and even tonic and mild purgatives, in moderate doses, such as the combination of small doses of calomel or the mercurial pill with the extract of colocynth, or the compound rhubarb pill, &c. In all chronic diseases purgatives may be used with considerable success, but they must be continued in many cases for a long period, and require the greatest attention not only to the nature of the purgative employed, but to its effect on the stools or alvine secretions. In cases of persons not invalids suffering from constipation, the best cure is likely to be found in a change of diet; for example, a greater quantity of such vegetables as boiled carrots, turnips, parsnips, &c., also apples and various other kinds of fruit, may produce the desired alteration. If, however, purgative medicines are occasionally used by those in ordinary health, senna, Epsom salts, castor-oil, or some other simple purgative, will answer better than any quack medicine.

A common classification of purgatives is the following:—(1.) *Laxatives or Mild Cathartics*, such as manna, cassia pulp, tamarinds, prunes, honey, phosphate of soda; castor, almond, and olive oils; ripe fruit. (2.) *Saline or Cooling Laxatives*, such as Epsom salt, Glauber's salt, phosphate of soda, Seidlitz powders, &c. (3.) *Active Cathartics*, occasionally *acid*, frequently *tonic and stomachic*, such as rhubarb, senna, and aloes. (4.) *Drastic or Violent Cathartics*, such as

jalap, scammony, gamboge, croton-oil, colocynth, and elaterium. (5.) *Mercurial Purgatives*, such as calomel, blue pill, quicksilver with chalk, &c.

PURGATORY, according to the dogma of the Roman Catholic Church, is the intermediate state between death and the final judgment, in which the souls of the righteous expiate, through temporary suffering, the sins committed in this life, and are rendered sufficiently pure to enjoy the happiness of heaven. The Catholic Dictionary, by Addis and Arnold, tells us that it is 'a place in which souls who depart this life in the grace of God suffer for a time because they still need to be cleansed from venial, or have still to pay the temporal punishment due to mortal sins, the guilt and the eternal punishment of which have been remitted. Purgatory is not a place of probation, for the time of trial, the period during which the soul is free to choose eternal life or eternal death, ends with the separation of soul and body. All the souls in purgatory have died in the love of God, and are certain to enter heaven. But as yet they are not pure and holy enough to see God, and God's mercy allots them a place and a time for cleansing and preparation. At last Christ will come to judge the world, and then there will be only two places left, heaven and hell.' The doctrine of purgatory as an article of faith does not seem to have been established till the tenth century, and the statements of the councils regarding it are very meagre. All that the Council of Trent lays down as of faith is that there is a purgatory, and the souls there detained are helped by the prayers of the faithful, and especially by the acceptable sacrifice of the altar. The catechism of the Council of Trent adds that there is a purgatorial fire, in which the souls of the righteous are purified by temporary punishment. The ordinary teaching of the church supplements such meagre details in various respects. The writers above quoted, for instance, assure us that 'The souls in purgatory suffer the pain of loss—i.e. they are in anguish, because their past sins exclude them for a season from the sight of God, and they understand in a degree previously impossible the infinite bliss from which they are excluded and the foulness of the least offence against the God who has created and redeemed them. They also undergo 'the punishment of sense', i.e. positive pains which afflict the soul. It is the common belief of the Western Church that they are tormented by material fire, and it is quite conceivable that God should give matter the power of constraining and afflicting even separated souls.' This doctrine the R. Catholics hold to be confirmed both by the testimony of Scripture and by apostolic tradition, but they do not insist very strongly on the evidence of particular texts, few of which, indeed, can be adduced as in any way supporting the doctrine. They rather appeal to general principles taught in Scripture, to the necessity of discipline and of holiness and purity in those who would see God, but especially to the practice of praying for the dead, which undoubtedly existed at a very early date. 'The difficulty of proving the doctrine as generally held seems to have been recognized by the Council of Trent, since it only speaks vaguely of souls detained in purgatory. The conceptions of the fathers regarding a purgatorial fire were so varied and contradictory that they never took shape in a dogma. Augustine has implicitly denied the existence of purgatory. 'Let no one,' he says, 'deceive himself; there are only two places (for souls); no third place exists.' He expresses himself in similar terms in other parts of his works. Augustine, however, was not by any means consistent in his opinions, and he was the first who advanced as an hypothesis the possibility of the existence of a

purgatorial fire in the interval between death and the resurrection. On the whole, the fathers of the Western Church seem to have favoured the doctrine of an intermediate state, in which the faithful departed had to undergo temporary suffering. Gregory the Great gave the doctrine a remarkable extension; and later on it was, as we have seen, made an article of faith binding on the whole church. The doctrine of purgatory was rejected by all the reformers of the sixteenth century, and earlier by the Waldenses and other sects. The Greek Church has never held this doctrine in the same sense as the Roman, though it admits the cognate one of prayer for the dead. The general teaching of the orthodox Greek Church and other Eastern churches seems to be that on the whole the state of the faithful departed is one of 'light and rest and peace and refreshment, of happiness far greater than any belonging to this life, yet inferior to that which shall be enjoyed after the resurrection and final judgment'; yet the Greeks seem to admit that some souls in the intermediate place are in a state of suffering. The Church of England, in its twenty-second article, expressly condemns 'the Romish doctrine concerning purgatory', but this has reference more especially to the doctrine in its extreme form, and as connected with the sale of indulgences in Germany. A belief in an intermediate state is common among Anglicans, and is held also by many others.

Besides maintaining the inconclusiveness of the texts of Scripture cited in support of a purgatory, and the inapplicability to the doctrine of the so-called testimony of the fathers, Protestants in general argue that Scripture speaks of departed souls going, immediately at death, to a fixed state of happiness or misery, and gives us no idea of purgatory; and they consider it strange also, if such sufferings await those who are to be finally saved, and if it is possible through the instrumentality of the living to mitigate these sufferings, that no mention of either the evil or its remedy is made in any part of the New Testament.

PURIFICATION, a Jewish rite, through the performance of which an Israelite, ceremonially unclean, was readmitted to the privileges of religious communion, lost through uncleanness. The ground element in purifications was water; but various and sometimes very elaborate ceremonies were observed according to the nature of the uncleanness from which the person was to be purified. The taint of uncleanness was removed in some cases by simple ablution of the person (Lev. xv. 18), in others by ablution of the clothes (Lev. xi. 25-40). Higher degrees of uncleanness required among other things a probationary interval of greater or less extent and offerings of atonement, as in the case of men having issues (Lev. xv. 1-15), in the 'custom of women' (Lev. xv. 19-30), and in the uncleanness of childbirth (Lev. xii.). The highest degree of uncleanness was connected with death, death being the penalty of sin. The method of purifying persons who had contracted uncleanness through contact with a dead body is detailed in Numbers xix., and that regarding leprosy is fully described in Lev. xiv. 4-32. Different from that noticed above was the purification performed in the consecration of priests, and that to be undergone by proselytes at baptism. Besides these ablution was necessary prior to the performance of special religious acts. Purification was not peculiar to the Jewish nation; it was observed among the Greeks, Persians, and other nations. The Jewish rite, however, possessed this distinctive feature, that it was of an expiatory nature. 'The Jew alone was taught by the use of expiatory offerings

to discern to its full extent the connection between the outward sign and the inward fount of impurity.'

PURIFICATION OF THE BLESSED VIRGIN MARY, FEAST OF THE, called also 'the feast of the presentation of the child Jesus'. A festival held on the 2d of February in commemoration of the day on which Mary entered the temple, 'when the days of her purification, according to the law of Moses, were accomplished', there to present the infant Jesus to the Lord, and offer the sacrifice of a pair of turtle-doves required by the law (Luke ii. 24). The institution of the festival dates from a very remote period of the Christian Church. It was introduced into the Roman Church in 494 by Pope Gelasius, and it was sought to substitute it for the pagan festival of the Lupercalia, celebrated in honour of Pan, the god of shepherds. In the celebration of the Catholic festival it is the practice for each of the processionists to carry a lighted taper, which signifies, according to the interpretation of the mystics, the light which Jesus came to bring into the world.

PURITANS, in the English Church, a sect who professed to follow the pure Word of God, in opposition to traditions, human constitutions, and other authorities. The Reformation in England was brought about in a manner quite different from that in which it took place in other countries. A purely personal affair of Henry VIII. was the immediate occasion of the change which from a Catholic country converted England into a Protestant one. Occurring at a time when the nation was scarcely ripe for the change, and under the peculiar circumstances under which it did occur, the Reformation was not so complete as it might otherwise have been. The consequence of this was that the more advanced reformers were dissatisfied with what they considered the imperfectness of the change, and with the retention in the reformed Church of England of much that savoured of Catholicism. This party continued to grow in numbers and in importance, and in the reign of Queen Elizabeth the Protestants were divided into two parties, those who were in favour of adhering to the liturgy established in the reign of Edward, and those who wished to introduce a simpler, and, as they considered it, a purer form of church government and worship. The latter were termed *Puritans*, and many of the distinguished clergy favoured these views. The queen, however, and a majority of the clergy preferred the Episcopal form of government, and were attached to many forms and ceremonies upon which the Puritans looked with aversion. The rigorous measures followed by the dominant party to compel conformity only served to alienate the Puritanical party, and to push them into more decided opposition to the ceremonials of divine worship. In 1566 the Puritans resolved that duty required them to break off from the church, and assemble as they best could by themselves, to worship God in their own way; they also laid aside the English liturgy, and adopted the Geneva service-book. They objected further to the hierarchy, as not authorized by Scripture, to kneeling at the sacraments, using the sign of the cross in baptism, bowing at the name of Jesus, wearing the surplice and other vestments in divine service, &c. In point of doctrine there was as yet no difference between the Puritans and Conformists; the former, however, as was natural for a persecuted party, maintained that every man had a natural right to judge for himself, without being subject to the laws of the civil magistrate, or the decrees of councils, churches, or synods. Towards the end of Elizabeth's reign a party arose which were first for softening, and then for overthrowing, the received opinions concerning

predestination, perseverance, free-will, effectual grace, and the extent of Christ's redemption. The clergy of the church began to lean towards Arminianism, while the Puritans adhered rigorously to the system of Calvin, and all Calvinists, whether Episcopal or Presbyterian, were called *doctrinal Puritans*. The name was applied to all who were remarkably strict in their morals, and severe in manners. Elizabeth treated the Puritans with great rigour during the whole of her reign; besides the ordinary courts of the bishops, she erected the court of high commission, which suspended and deprived the refractory of their livings, by the determination of three commissioners, founded upon the canon law; before this court the prisoner was obliged to answer questions put to him under oath; if he refused to swear he was imprisoned for contempt, and if he took the oath he was convicted upon his own confession. During the reign of James I., from whom the Puritans had expected more indulgence, they were treated with greater severity, and many of them left the kingdom and retired to Holland, whence they emigrated to America in 1620. All who opposed the arbitrary maxims of his government were looked upon by James and the court as *Puritans*, and these were called *Puritans* in state, who, uniting with the *church Puritans* in opposition to the tyrannical principles of the Stuart dynasty, formed a majority in the nation. The success of the first emigrants to America, who established the colony of New Plymouth, induced great numbers of Puritans to turn to the same quarter for relief, and the new colony of Massachusetts Bay was founded by them in 1629. The colony of New Haven was also founded by Puritans who fled from the persecutions of Laud, and the oppressions of the Star Chamber and the high commission courts. Though there were shades of difference in these fugitives to America, they agreed in most points of doctrine and discipline, and most of their descendants in New England, of which they compose a principal part of the population, still cherish with fondness the maxims and the memory of their Puritan fathers. The Puritans were afterwards prevented from retiring to America, and many of them removed into Holland, while others remained at home and finally pulled down the throne and the altar, which long persecutions had rendered so odious to them. (See CROMWELL, HAMPIEN, PYM, &c.) It was the union of the three kinds of Puritans above-mentioned which gave the Parliament the victory in the civil war which followed. The Presbyterian party was at first the most powerful, but the Independents, among whom were Cromwell, Milton, &c., finally acquired the ascendancy; and it was this party, most of whom were republicans in politics as well as in church discipline, that beheaded the king and abolished royalty. After the Restoration, the act of uniformity (1662) excluded from the church all who refused to observe certain rites and subscribe certain doctrines; and from that time the name of *nonconformists* came into use. See NONCONFORMISTS, and ENGLAND—Church; Neal's History of the Puritans (four vols. 1732-38; often reprinted); the works of S. R. Gardiner; Masson's Milton; Campbell's The Puritan in Holland, England, and America (two vols. 1892); Gregory's Puritanism in the Old and in the New World (1895).

PURNIAH, a town of Hindustan, in Bengal, province of Behar, capital of the district of the same name, 230 miles north by west of Calcutta, consists of the town proper and a series of straggling suburbs. The town incloses a space of about 3 miles square, much of it, however, occupied by plantations, gardens, and open places. The best part, situated on the left bank of the Little Kusi, consists of three

parallel streets, one of them about half a mile long, wide, tolerably straight, and lined with houses which are generally well built and tied. Among the inhabitants are a number of wealthy capitalists engaged in banking. Pop. (1891), 14,555.

PURPLE. The colour to which the ancients applied the name *purpl* was either dark, or violet and rose-coloured, and was one of the most costly dyes with which they were acquainted. They obtained their purple dyes partly from plants, and partly from several kinds of shell-fish, as the *buccinum*, and the *murex* or *purpura*. In modern times a similar purple matter has been found in several other shell-fish. It is a viscid juice contained in a little pouch or bag, lying generally between the heart and liver. The colour of the juice varies, being in some purplish red, in others pale yellow or orange coloured. Réaumur found that the juice taken from one of these shell-fish, on being applied to linen, changed in the course of a few seconds from yellow to green, blue, and finally to purplish red. The juice of the *sea-snail*, found by the Spaniards in Peru, and used for dyeing, presents similar phenomena. Cochineal is much used for purple dyes by the moderns. The ancients attributed the discovery of purple to the Phœnicians. The story of its having been discovered by a dog biting a purple-fish, and thus staining his mouth, is well known. The purple fish was found not only on the Phœnician coasts, but in all other parts of the Mediterranean, so that the use of it in dyeing came to be common with other nations; but the Phœnicians excelled in the beauty and permanence of their colouring. The Tyrians excelled particularly in the bright red and violet shade. They dyed the finest wools of this colour, usually twice, and then gave an artificial brilliancy to the stuff. But as the colouring fluid could only be had in very small quantities from the shell-fish, purple-dyed garments were reckoned of almost priceless value (comp. Jer. x. 9; Ezek. xxiii. 6; Dan. v. 7). The modern discovery of purple colours from coal-tar makes an important epoch in the history of the dye.

PURPLE GRACKLE. See CROW-BLACKBIRD.

PURPLE OF CASSIUS, a purple substance used to some extent in the arts, discovered by Dr. Cassius at Leyden in 1683. This substance is probably an oxide of gold containing small quantities of oxide of tin; it is prepared by adding protochloride of tin, along with a little perchloride, to a solution of chloride of gold, when it is thrown down in the form of a dark purple-coloured precipitate. Purple of Cassius, mixed with borax and applied to the surface of china, imparts a beautiful rose-pink or rich purple colour, according to the quantity employed. It is also used for colouring red Bohemian glass.

PURPLES, THE, or PURPURA, a disease in which the surface of the body is covered with specks or patches of a dark purple or livid colour, the eruption being accompanied with great debility, and frequently a degree of fever. The specks or patches are the result of extravasation from the minute vessels beneath the cuticle, and resemble the petechiæ seen in bad typhus fever, or the spots in cases of sea-scurvy. The worst form of this disease is the *purpura hæmorrhagica*, or bleeding purpura, in which the blood is often effused in large quantities from the surface, giving rise to great prostration of strength, and it sometimes terminates fatally. This disease is limited to no age or sex, but women, and also boys before the age of puberty, are more liable to it than others, especially those of delicate constitutions who live in cold damp houses. The treatment depends essentially on the habit of body and the age and strength of the patient. It depends also upon the cause of the disease, if any special cause can be discovered. Thus

when it occurs in the course of some organic disease, disease of the heart, for example, or Bright's disease of the kidney, that circumstance will to a large extent determine the treatment. As a rule, tonic treatment is required, such as quinine and iron, also small doses of the mineral acids frequently repeated, combined with decoction of Peruvian bark; and when typhoid symptoms appear the constitution should be supported by means of wine and other stimulants. For diet during the progress of the malady milk, in conjunction with rice and farinaceous articles, should be allowed, also fresh vegetables and fruits.

PURPLES, EAR COCKLE, or PEPPERCOORN, a disease affecting the ears of wheat, produced by a minute Nematoid worm (see NEMATELMIA), allied to the well-known Vinegar Eels, and termed the *Tylenchus* or *Vibrio tritici*, or 'Wheat Eel.' These forms appear to enter the young plant at an early period of its growth, and reach the seeds or ovules when quite soft. They then deposit their ova and die, the young being developed in about eight or ten days. These cause the formation of the purplish-black galls or 'cockles' which are a feature of the disease, and in which the worms are contained. In their early state the young vibrios may measure $\frac{1}{4}$ of an inch in length and about $\frac{1}{16}$ of an inch in diameter. When fully grown they may attain a length of $\frac{1}{2}$ inch and $\frac{1}{4}$ of an inch in diameter. The vitality of these forms seems to resemble that of the Rotifera or 'Wheel Animalcules,' in that they may be desiccated or dried, and restored again on the application of moisture many times in succession. No absolute remedy for this disease is known.

PURPURA, a disease. See PURPLES (first article).

PURSE, among the Turks, the sum of 500 piastres, or £4, 10s. sterling. In Persia the purse is 50 toman, or £23, 4s. 7d., the toman being worth 9s. 3½d. sterling.

PURSER, in the navy, formerly an officer who took charge of the provisions and slops of a ship of war, and saw to their distribution among the officers and crew. He had very little to do with money matters, but generally bore an evil reputation among the sailors for unfair dealing and rapacity. The designation is now discarded for that of *paymaster*, who holds a different position.

PURSLANE (*Portulaca oleracea*, natural order Portulacaceæ), a plant said to have come originally from India, but now almost universally diffused through the civilized world. The stems divide from the base into several prostrate branches, which are clothed with sessile, smooth, and wedge-shaped leaves; the flowers are small, yellow, and axillary. The whole plant is succulent. Formerly it was cultivated as a pot-herb for salads, garnishings, and pickling, and it is still sometimes employed for those purposes.

PURSUIVANT. See POURSUIVANT.

PUS, the yellowish and somewhat viscid matter that appears as the result of inflammation, and accumulates in abscesses, and on the surface of what are called healthy sores. See INFLAMMATION.

PUSEY, EDWARD BOUVERIE, an eminent theologian and Anglican divine, was born in 1800, and was a son of the Hon. Philip Bouverie (of the Radnor family), who assumed the name of Pusey by royal license on becoming lord of the manor of that name in Berkshire. He was educated first at Eton, then passed to Christ Church, Oxford, where he graduated B.A. with high honours. Soon after he was elected to a fellowship at Oriel College. He studied some time in Germany, taking up more especially oriental languages, theology, and German, and as early as 1828 was appointed Regius Professor of Hebrew, a post which he retained all his life, and

to which a canonry at Christ Church is attached. From that period dates Pusey's fame as a polemical theological and ecclesiastical writer. One of his first productions was a book on the rationalistic views regarding religion which were common in Germany, founded on his own personal experience of what he believed to be the evils of Rationalism. He became an ally of the theological party who started the Tracts for the Times (see TRACTARIANISM), but the agitation had been going on a little time before he took an active part in it. His first tract was the eighteenth, On the Benefit of Fasting; he subsequently wrote another (the sixty-sixth) on the same subject, and two (the sixty-seventh and sixty-ninth) On Holy Baptism. In connection with the same High Church movement he undertook the joint-editorship of the Library of the Fathers and the Library of Anglo-Catholic Theology. In 1843 he was suspended from preaching in the university pulpit for three years on account of a sermon on the Eucharist, in which he not only advocates the doctrine of the real presence, but also that of sacerdotal absolution and of the duty and privilege of confession. Except for literary labours and occasional sermons, Dr. Pusey's life was henceforward an uneventful one. Among his chief works are a treatise on The Ancient Doctrine of the Real Presence, Letters to the Archbishop of Canterbury in Defence of Church Principles, a treatise on Marriage with a Deceased Wife's Sister, a History of the Councils of the Church (1857), a learned Commentary on the Minor Prophets (1860-77, six parts), an important contribution to Hebrew scholarship. Nine Lectures on Daniel the Prophet (1864), and The Church of England, or Portion of Christ's Holy Catholic Church: an Eirenicon (1865). He died at Ascot Priory, Berks, on the 16th Sept. 1882. Of all the leaders of the Tractarian or High Church party he was the only popular preacher, and it was his influence that kept a large section of that party from drifting into the Church of Rome with Newman and many others. On this ground, perhaps, the party received the popular name of Puseyites. He was very retired in his habits, but was kind-hearted, and his charity was unbounded. See the Life by Liddon and others (four vols. 1893-97).

PUSHKIN, ALEXANDER, an eminent Russian poet, son of a landed proprietor, was born at St. Petersburg in 1799, and received his first education in the Lyceum at Zarskoje-Selo. He very early began writing verses, and in his fourteenth year published a poem entitled Recollections of Zarskoje-Selo. The very favourable reception given to it so overjoyed him that he abandoned all other studies and lived for poetry alone. Afterwards, however, on returning to St. Petersburg, he took the wiser course of giving much of his time to the study of history and the ancient classics. With the spirit of youth, and inspired by the free spirit of the ancients, he wrote an Ode on Freedom, which led to his banishment from the capital in 1820. On the accession of the Emperor Nicholas in 1825 he was restored to favour, and the appointment of imperial historiographer was conferred upon him. His best works are Ruslan and Ljudmilla, an epic in six cantos; the Mountain Prisoner, a fresh and vigorous picture of the predatory habits of the Caucasian mountaineers; and above all, the Fountain of Bakhissarai. Mention may also be made of his portraiture of a young libertine under the name of Eugene Onegin. His dramatic poem, Boris Godunov, is an excellent and lively picture of the manners of that period. One of his greatest defects is a manifest and often slavish imitation of Byron. He died in 1837, his death being occasioned by a wound he received in a duel.

PUSHTU, the language of the Afghans, a member of the Aryan or Indo-European family.

PUTEAUX, a town of France, in the environs of Paris, on the left bank of the Seine. There are many fine villa residences here, and much ground laid out in vegetable gardens. Pop. (1896), 19,769.

PUTEOLI. See **POZZUOLI**.

PUTNEY, a suburb of London, in the county of London, in Wandsworth borough, on the right bank of the Thames, opposite Fulham, with which it is connected by a fine granite bridge; a great rowing centre. Gibbon the historian was born here. Pop. (1881), 13,235; (1891), 17,771; (1901), 24,139.

PUTREFACTION is a phenomenon due to the presence of germs or microbes, which cause a similar alteration in putrescible matter to that produced in fermentation. These microbes are present in great numbers in ordinary air and water, and multiply in the midst of the putrefying matter, decomposing and disorganizing it, and generating in the process a great number of gases and liquid products of a more or less putrid odour. Putrefaction takes a certain time to declare itself, according to the circumstances of temperature, &c. In the most favourable circumstances it will take at least twenty-four hours before the phenomenon begins to show itself by external signs. Putrefaction is prevented by the exclusion of all air, or by the action of intense cold, which states are opposed to the development of the microbes. The gases generated in process of putrefaction are carbonic acid, nitrogen, carburetted and sulphuretted hydrogen, &c. The most effective anti-putrefactives or antiseptics are salt, alcohol, carbolic acid, kresote, and various other substances. See **DECOMPOSITION**.

PUTTY, a kind of paste, compounded of whiting and linseed-oil, beaten together to the consistence of a thick dough. It is used by glaziers for the purpose of fixing sheets of glass in the frames of windows, &c., and also by painters for filling up holes in the surface they are about to paint. It becomes very hard when it dries.

PUTTY-POWDER, a substance consisting of the peroxide of tin. When tin is melted in an open vessel its surface soon becomes covered with a gray powder, which is an oxide of the metal. If the heat is continued the colour of the powder gradually changes, and at last becomes yellow. This scum is then taken off, and after being allowed to cool is reduced to a very fine powder. In this state it is much employed in polishing glass and other hard substances. It is also used as a colouring matter for white glass, the white enamels of porcelain, &c.

PUY, or **PUY-EN-VELAY**, LE, a town of France, the capital of the department of Haute-Loire, 270 miles S.S.W. of Paris, picturesquely situated on the south slope of Mount Anis, on which it rises in the form of an amphitheatre between the Borne and the Dolaizon. Overtopping the houses is a rock crowned with a colossal bronze statue of the Virgin made from cannon taken at Sebastopol, and on another rock rising abruptly from the Borne to the height of 265 feet, is an ancient Romanesque chapel, approached by a stair partly cut in the rock. Many of the streets are narrow and steep. The principal edifices are a heavy Romanesque cathedral on a commanding height; the large church of St. Laurent, in which the Constable Du Guesclin is buried; a prefecture; and there are some interesting Roman remains. The manufactures are chiefly lace, tulle, and woollens. Pop. (1886), 15,664; (1896), 16,805.

PUY-DE-DÔME, a central department of France; area, 3070 square miles. It consists of an extensive undulating valley, flanked east and west by lofty ramifications of the Cevennes. Its mountains, situated chiefly in the west, form two groups—one in the north consisting of rounded volcanic cones, generally called *Monts-Dômes*, of which the celebrated Puy-

de-Dôme, 4805 feet, is the culminating point (see **CEVENNES**); the other consists of lofty peaks called *Monts-Dores*, of which the culminating point, Puy-de-Sancy, 6225 feet, is the loftiest mountain in the interior of France. Many of the craters of these extinct volcanoes are as well marked as those of volcanoes now existing, and the streams of lava which flowed from them can be traced for miles. In the lower localities the vine is cultivated, and large quantities of wheat, hemp, and flax are grown; in the higher localities rye and oats are the principal crops. The loftier mountain districts abound with pastures, which are verdant almost to the mountain summits, and feed vast numbers of cattle and sheep. Coal is worked in several places. The arrondissements are: Ambert, Clermont-Ferrand, Issoire, Riom, and Thiers. Clermont-Ferrand is the capital. Pop. (1896), 541,669; (1901), 529,181.

PUZZOLANA. See **POZZOLANA** and **CEMENTS**.

PWLLHELI, a mun. and parl. bor. (Carnarvon district) and watering-place of North Wales, in Carnarvonshire, on Tremadoc Bay. A harbour of refuge is to be constructed. Pop. (1901), 3675.

PYÆMIA (Greek, *puon*, pus, and *haima*, blood), a disease due to the presence in the blood of some morbid material of organic nature, which acts as a poison, producing symptoms characteristic of general blood-poisoning, and also lesions in various organs, such as the lungs, the digestive organs, the joints, the skin, &c. A chief form of such local lesions is abscesses. In the majority of cases the absorption of the poison occurs at the site of some wound or injury or local inflammation. Before the antiseptic method of treating wounds was adopted it frequently arose subsequent to an operation, and it is not uncommon after child-birth, giving rise to a form of puerperal fever. When it occurs in connection with a wound the wound will usually be found foul, giving rise to an offensive discharge, and the healing process will be arrested. The onset of the disease is usually sudden, and is indicated by rigors, violent shivering, and fever, followed by profuse sweating. It is attended by weak rapid pulse, frequently by diarrhœa; the tongue is dry and brown; there is great thirst, restlessness, and muttering delirium; and the prostration of strength is rapid and extreme. Death may occur within forty-eight hours from the general infection of the system, and before there is any evidence of the involvement of any particular organ. Usually the illness does not end fatally for seven or ten days, and in less acute cases many weeks, though recovery in a few cases occurs. When death is delayed for some days the symptoms of involvement of lungs, joints, &c., have time to develop. As to treatment, scrupulous care in the dressing of wounds and in the maintenance of cleanliness are necessary for prevention of an attack. When an attack has set in, the strength of the patient should be supported by stimulants and nourishing foods, and full doses of quinine, 5 to 10 grains, should be given several times a day.

PYCNOGONUM, a genus of animals, resembling both the Arachnida and the Crustaceans. They are popularly known by the name of 'Sea Spiders,' are all marine and of small size, and some of them live as parasites upon fishes, whales, and other marine forms. The body is short and thick, the eight limbs being longer than the body, and remarkable as containing prolongations of the digestive system. The mouth bears a pair of mandibles provided with *chela* or pincer-like claws. In the female a pair of false legs are used for carrying the ova or eggs. The sexes are distinct. No specialized breathing organs exist, and it is doubtful if a heart is developed. The common British species is *Pycnogonum littorale*. It is

not parasitic, and is found on our coasts at low-water mark, crawling on sea-weed or beneath stones. *P. gracile* is another species, whilst *P. Balanarum* attaches itself parasitically to whales.

PYGMALION, a prince of Cyprus, who, disgusted with the debaucheries of his countrywomen, took an aversion to the sex. According to Ovid (*Met.* x. 243), having made a female statue of ivory he was so enchanted by its beauty that he fell in love with his own work, and entreated Venus to endow it with life. His prayer was granted; the statue began to breathe and live before his eyes, and in his embrace. It became his wife, by whom he had Paphos, the founder of the city of the same name. Gilbert's drama of *Pygmalion and Galatea* is founded on this story. Another *Pygmalion*, King of Tyre and Sidon, was brother of Dido.

PYGMY (Greek, *pygmaios*, dwarfish). The Pygmies were a fabulous nation of dwarfs, who were said to live near the sources of the Nile, or, according to some, in India. Homer mentions them as threatened with death and destruction by the cranes (*Il.* iii. 3). Later writers are more minute in their accounts. Pliny says that their towns and houses were built of egg-shells; and according to Philostratus they cut down their corn, as one would fell a tree, with axes. The latter also speaks of an army of Pygmies which attacked Hercules while sleeping after his struggle with Anteus. They made such preparations for the assault as if they were to attack a city. But the hero, on awaking, laughed at the little warriors. It has been ascertained within recent times that one or two pygmy races exist in Central Africa.

PYLADES, son of Strophius, king of Phocia, and Anaxibia, the sister of Agamemnon, celebrated for the friendship which existed between him and Orestes. He assisted Orestes in murdering his mother Clytemnestra, and also accompanied him to the Tauric Chersonesus. He eventually married Electra, the sister of his friend. See **ORESTES**.

PYLORUS. See **STOMACH**.

PYLOS, a town of ancient Greece, in the south-west of Messenia, on a promontory at the north entrance to what is now called the Bay of Navarino. The inhabitants, after offering a brave resistance to the Spartans in the second Messenian war, were obliged to quit it with the rest of the Messenians, and the town was laid in ruins. This or another town of the same name is said to have been governed by Nestor. See **NAVARINO**.

PYM, JOHN, a parliamentarian in the reign of Charles I., was descended of a good family in Somersetshire, where he was born in 1584. He was educated at Pembroke College, Oxford, and in 1602 entered the Middle Temple, but he was never called to the bar. He became member of Parliament for Calne in 1614, but from 1625 sat for Tavistock. He took a prominent part in the impeachment of the Duke of Buckingham in 1626. In 1639, with several other commoners and lords, he held a close correspondence with the commissioners sent to London by the Scottish Covenanters; and when Parliament, which had not assembled since 1628, met again in 1640, Pym was one of its most active and leading members. It was not, however, till the meeting of the Long Parliament, towards the latter part of the same year, that he came most prominently to the front. Possessed of great eloquence, he made a vigorous and effective speech as soon as Parliament had opened, in which he dwelt at length upon the grievances of the nation with respect to parliamentary privileges and civil and religious liberty. He did not, however, stop here, but a few days later followed up his speech by bringing forward a charge of high treason against the Earl of Strafford, prime minister of Charles I.;

and in the impeachment which followed, and which resulted in the death of Strafford, he took the leading part. In 1641 a motion was carried by the opposition party to submit a remonstrance to the king exposing the defects of his administration since ascending the throne, and it was the zeal and earnestness of Pym in this matter which led Charles into the imprudent measure of going to the Parliament in person to seize him and other four members. Pym strenuously opposed every overture of peace, and at last hostilities commenced by the breaking out of the civil war in August, 1642. Clarendon relates that Charles I., feeling the necessity of gaining at any cost an enemy at once so implacable and so skilful, offered to Pym the post of chancellor of the exchequer. We are not told what reply he made to this offer; but without being quite so virulent in his speech, he still continued the determined opponent of the king. Some time before his death he drew up a defence of his conduct, which leaves it doubtful what part he would have taken had he lived until hostilities commenced. In November, 1643, he was appointed lieutenant of the ordnance, and died December 8 of the same year. He was buried with great pomp in Westminster Abbey, his body being carried by six members of the House of Commons. The character and life of Pym have been variously judged by his contemporaries according to their sympathies. By some held in the highest esteem, he was accused by others of being actuated by personal animosity. See the *Life* by Forster (1837), Goldwin Smith's *Three English Statesmen* (1867), and S. R. Gardiner's works.

PYRALIS. See **MOTH**.

PYRAMID, in geometry, is a solid having any plane figure for its base, and triangles for its sides, all terminating in one common point or vertex. If the base of the pyramid is a regular figure, the solid is called a *regular pyramid*, which then takes particular names according to the number of its sides, as *triangular*, *square*, *pentagonal*, &c., the same as the prism. (See **PRISM**.) If a perpendicular from its vertex falls on the centre of the base, the solid is called a *right pyramid*, but if not it is *oblique*. The principal properties of the pyramid may be stated as follows:—1. Every pyramid is one-third of a prism of equal base and altitude. 2. Pyramids of equal bases and altitudes are equal to each other, whether the figure of their bases be similar or dissimilar. 3. Any section of a pyramid parallel to its base will be similar to the base, and these areas will be to each other as the squares of their distances from the vertex. 4. Pyramids, when their bases are equal, are to each other as their altitudes; and when their altitudes are equal, they are to each other as their bases; and when neither their bases nor their altitudes are equal, they are to each other in the compound ratio of their bases and altitudes. The solidity of a pyramid is found by multiplying its base by its perpendicular altitude, and taking one-third of the product. *Frustum* of a pyramid is the solid formed by cutting off the upper part of a pyramid by a section parallel to its base.

PYRAMID (Greek, *pyramis*), in architecture, a colossal structure of masonry having a rectangular base and four triangular sides terminating in a point, used by the ancients in various parts of the world either for sepulchres or for religious purposes. The derivation of the term is unknown. Some derive it from the Greek *pur* (fire), because the form of the pyramid is like a flame; others from *pyros* (wheat, grain); while others again assign to it an Egyptian origin. According to Herodotus the Egyptians considered the pyramidal form as an emblem of human life. The broad base was significant of the beginning, and its termination in a point of the end of our exist-

ence in the present state; for which reason they made use of this figure in their sepulchres. The most remarkable pyramids are those of Egypt and Nubia and those of Mexico. The Egyptian pyramids have for ages been a source of interest and curiosity, and in ancient times were regarded as forming one of the seven wonders of the world. They are built mainly of a hard limestone, but large blocks of granite are also used, especially on the outside. The four sides are so placed as to face the four cardinal points. Being intended both as monuments and as tombs, they contain one or more sepulchral chambers, quite small compared with the total mass. They appear to date from the period of the third dynasty to the twelfth (say 2500–2000 B.C.), after which none were built. Each pyramid was commenced over a sepulchral chamber excavated in the rock, and the work went on during the lifetime of the king for whom it was intended. A low narrow passage was kept open as the tiers of stone were added, in order that access might be obtained to the central chamber from without; and when the monarch died the work ceased, and the last layers were then finished off and the passage closed up. The angles formed by the recession of each superior layer were filled up with small stones and bevelled off, so as to give a smooth sloping surface to the sides. The stones used varied in thickness from 2 feet to 4 feet, and the mechanical skill requisite to quarry these and to raise them to such great heights and adjust them in their proper places continues a matter of universal astonishment. No indication of the mechanical contrivances used for this purpose has been left, though that they possessed such can hardly be doubted. The fact that an almost fabulous number of labourers were engaged in erecting these pyramids did not lessen the necessity for the employment of certain machines. The pyramids now standing, all in Middle Egypt, are divided into five groups, containing in all about forty pyramids. The district in which the pyramids stand begins above Dashur, and extends by Sakkara and Memphis along the western margin of the valley of the Nile for about 60 or 70 miles, the last or Gizeh group being but a few miles above Cairo. The group of Gizeh, in the neighbourhood of the ancient Memphis, is the most remarkable. It consists of nine pyramids, and comprises the three most celebrated monuments of the kind in existence, namely, the pyramid of Cheops, called the Great Pyramid; that of Cephren, and that of Mycerinus—the last much smaller than either of the two first. According to Herodotus the Great Pyramid was built by Cheops. It took 100,000 men working for ten years to make a causeway 3000 feet long, to facilitate the transportation of the stone from the Turah quarries; and the same number of men for twenty years more to complete the pyramid itself. Herodotus further describes the method of building by steps, and raising the stones from layer to layer by machines, and finally of facing the external portion from the top down. Diodorus calls the builder of this pyramid Chembes or Chabryes, and by Manetho and Eratosthenes he is called Suphis. The latter name corresponds to Shufu, deciphered from the hieroglyphics upon some stones discovered by Colonel Vyse in his important investigations of this pyramid in 1835. The pyramid at present covers an area of more than 12 acres. The base is about 750 feet square, but was formerly about 768 feet. The perpendicular height, which before the disappearance of the apex was about 482 feet, is now 451 feet. The area at the top is about 12 yards square. The outer casing of small stones has been removed, and the appearance the sides now present is that of a series of ascending steps. By these steps, which number 208, the ascent is made comparatively

easy, though the lower ones are 4 feet 10 inches high. The content of solid masonry has been estimated at 82,111,000 cubic feet. The only entrance is on the north face, 49 feet above the base, though the masonry about it has been so much broken away that the *débris* reaches nearly up to it. A passage 3 feet 11 inches high and 3 feet 5½ inches wide conducts from the entrance down a slope at an angle of 26° 41', a distance of 320 feet 10 inches, to the original sepulchral chamber, commonly known as the subterranean apartment; it is carried, reduced in dimensions, beyond this a distance of 52 feet 9 inches into the rock, though for what purpose remains a matter of conjecture. The sepulchral chamber is 46 feet long by 27 feet wide, and 11½ feet high. From the entrance passage another branches off and leads to several other passages and chambers. One of the latter, known as the *queen's chamber*, is situated about the centre of the pyramid, 67 feet above the base; it has a groined roof, and measures 17 feet broad by 18 feet 9 inches long, and 20 feet 8 inches high. The other, called the *king's chamber*, is reached by an offshoot from the queen's passage, 150 feet long. Its dimensions are 34 feet 3 inches long by 17 feet 1 inch wide, and 19 feet 1 inch high. The chamber is lined with red granite highly polished, single stones reaching from the floor to the ceiling, and the ceiling itself is formed of nine large slabs of polished granite extending from wall to wall. The only contents of the apartment is a sarcophagus of red granite, which, judging by its dimensions, must have been introduced when the building was proceeding. It is supposed to have contained a wooden coffin with the mummy of the king, and that these long since disappeared when the pyramids were first opened and plundered. The second pyramid, built by Suphis II. or Cephren, stands on a higher elevation than the Great Pyramid. Its original dimensions were 707 feet 9 inches square, and 454 feet 3 inches high; but these now stand 690 feet 9 inches and 447 feet 6 inches respectively, with an angle for its slope of 52° 20'. Part of the outer casing of the pyramid is still preserved. This pyramid has two entrances, and the passages to which they respectively give access lead to the same sepulchral chamber, in which is deposited a granite sarcophagus. It was reached with great difficulty by Belzoni in 1818. Belzoni found in it a Cufic inscription recording the visit of the Calif Alaziz Othman Ben-Yusuf, and the opening by him of the pyramid in 1196 A.D. The only remains met with were those of a bull. The third pyramid, built by Menkaré or Mycerinus, is only 354 feet 6 inches square and 203 feet high. It also was explored by Colonel Vyse in 1837. He discovered several chambers, one of which contained a sarcophagus and a mummy case bearing the name of King Menkaré, and also a body, supposed to be that of an Arab. The two latter are now in the British Museum, but unfortunately the sarcophagus was lost by the sinking of the vessel in which it was being transported to this country. This pyramid is the best constructed of the three; it was originally cased half-way up with black granite. The six smaller pyramids which complete the Gizeh group are supposed to form the tombs of some of the relatives of the kings who constructed the larger ones, and are of much inferior interest to the three above mentioned. Of the other groups of pyramids that at Abusir contains five; another at Sakkara contains eleven, one with a doorway inlaid with porcelain tiles and having a royal name; and a third group at Dashur contains five. Other pyramids are at Meydun and Illahun, and there are two at Biahmu. The pyramids of Nubia are very numerous; a single group north of Gebel Barkal comprises no fewer

than 120. In Babylonia the Birs Nimrud or Tower of Belus was a kind of step-shaped pyramid, built of bricks of different colours. It was erected by Nebuchadnezzar, and dedicated to the planets. Its height was 235 feet and its circumference 2286 feet. The Mujellibe in Babylon, of which the ruins are still to be seen, was another pyramidal structure of the same monarch. Ruins of pyramids are to be found at Benares in India and in other parts of the East. Certain monuments of the ancient inhabitants, found in Mexico, are also called pyramids. These seem to have been intended to serve as temples, the tops of them being flat and surmounted by a house or chamber in which sacred rites were probably performed. In this respect they resemble the Assyrian pyramids, which also were surmounted by a cell or chamber. These structures are usually built of brick, disposed in layers alternating with clay, or of a mixture of clay and pebbles, with a coating of stone overlaid with a plastering of lime, and the sides are formed into stories or terraces. The largest and perhaps the oldest of them is that of Cholula, which is said to have a base of 1770 feet and a height of 177 feet. The two pyramids of Teotihuacan are considered to be of the eighth century. They are situated in the centre of the plain of Otumba, to the north-east of the city of Mexico, and are called respectively the houses of the Sun and Moon. Both consist of four terraces or stages; the height of the 'House of the Sun' is 180 feet, and of the 'House of the Moon' 144 feet. Another remarkable monument of this kind is the pyramid of Papantla, near Vera Cruz, which is constructed of large blocks of sandstone cemented with mortar, its sides being formed into terraces. It is about 60 feet high, and has a base 120 feet square. (See MEXICO—Antiquities.) Lepsius, Ueber den Bau der Pyramiden, Vyse's Operations carried on at Gizeh in 1837; The Pyramids and Temples of Gizeh, by W. F. Petrie (1884), which gives new measurements of great accuracy.

PYRAMUS AND THISBE, an unfortunate pair of devoted lovers, who, as the story goes, resided in Babylon, and being prevented by the enmity subsisting between their respective parents from meeting openly, were in the habit of secretly conversing with each other through an opening in the wall, as their houses adjoined. Having agreed one day to meet at the tomb of Ninus, Thisbe, who was the first at the rendezvous, was surprised by a lioness and took to flight. In her haste she dropped her garment, which the lioness seizing covered with blood, having immediately before killed an ox. Meanwhile Pyramus appears on the scene, and concluding from the blood-beamed robe that his mistress is no more, he takes his own life. Thisbe returning soon afterwards, and finding the body of her lover dies in like manner by her own hand. A favourite mode of expression in the middle ages in reference to a couple unfortunate in love was to call them Pyramus and Thisbe. The story appears in Ovid's *Metamorphoses*, and we have a caricature of it in Shakspeare's *Midsummer Night's Dream*.

PYRENEES (Spanish, *Pirineos*; Latin, *Pyrænæ Montes*), a lofty mountain chain forming the boundary between France and Spain, and stretching across the whole of the isthmus which connects the Spanish peninsula with the rest of the European continent, and abuts with one extremity on the Mediterranean Sea, and with the other on the Atlantic Ocean. Its length, from Cape Creux, north of the Gulf of Rosas, to the Point of Figuièr, near Fuen-terrabia, is nearly 270 miles; and its breadth near the centre, where it is greatest, scarcely exceeds a third of the length, or 90 miles. Though the chain thus defined terminates at two opposite seas, it cannot

be said to be isolated, since to the west it is obviously continued across the north of Spain by the Cantabrian Mountains. The direction of the chain is *E.S.E.* to *W.S.W.* It does not, however, lie in the same straight line, but rather consists of two lines, which form parallel ridges about 20 miles distant from each other, except near the centre, where they become united by means of a remarkable rectangular elbow, in which some of the loftiest summits are found. Both on the north and south sides numerous branches are thrown off, generally at right angles to the principal axis, and subside rapidly as they recede from it, forming various transverse, but very few longitudinal, valleys. The chain rises both from the east and west towards the centre; and, in accordance with a general rule which holds in regard to the European chains which lie in the direction of the equator, the descent on the south side is much more abrupt than on the north. Owing to this the south has much fewer lakes than the north slope, but far surpasses it in the boldness and grandeur of its scenery. As already observed, the loftiest summits of the chain are near its centre. Its culminating point, Maladetta, situated there, has the height of 11,168 feet, and a great number of peaks in the same locality exceed 8500 feet. To the east of the centre the chain lowers so rapidly that its average height soon becomes little more than 2000 feet. To the west the height diminishes much more gradually, and many peaks have heights varying from 5000 to 7000 feet, and even 8000 feet. The principal passes in the Pyrenees formed by the meeting of valleys from opposite sides of the axis, take in the east part of the chain the name of Cols, and towards the centre that of Ports. No fewer than seventy-five are counted, of which twenty-eight may be crossed on horseback, and seven in wheeled carriages. The most frequented are those of Pertus and La Perche in the east, and St. Jean Pied de Port in the west. The nucleus of the chain is evidently granite, which, with the primitive schists which overlie it, constitutes the loftiest summits, with the exception of Mont Perdu (10,994 feet), Marboré (10,678 feet), and some huge adjacent masses which are formed of mountain limestone. The granite, however, seldom forms continuous ridges along the principal axis, but rather appears in a number of remarkable protuberances situated to the north of it. Above the micaceous schist and primitive limestone, which occur in connection with it, lie largely-developed strata of argillaceous schist and transition limestone, forming two great belts parallel to the primitive chain, one on the north and the other on the south side. Above these secondary rocks appear, of which by far the most common is the mountain limestone, which occupies the greater part of the south slope, but on the north side attains little elevation, being there almost entirely confined to the lower heights at the bottom of the principal chain. Above the mountain limestone the principal rocks are Jura limestone and trap. The number of thermal springs existing in the Pyrenees seems to indicate the presence of volcanic agents, but basalt and other rocks of igneous origin are very rare. The minerals of the chain include iron, copper, lead, zinc, manganese, antimony, and cobalt. There is no mine either of silver or gold, but particles of the latter are found in department Ariège, and in the streams of several other districts. The only mineral which has hitherto been worked to much advantage is iron. Mineral springs, both cold and thermal, are numerous, and much frequented by visitors. The limit of vegetation on the Pyrenees is about 600 feet higher than on the Alps. The rhododendrons, which in the latter are not found higher than 5000 feet, are here found at 5500 feet, and alpine plants are found on

the loftiest summits bordering on the region of perpetual snow. In the Pyrenees this is found only on the north slope, where it does not, as in the Alps, form a snowy zone, the lower limit of which looks as if traced out by an almost horizontal straight line; but, on the contrary, forms large isolated masses, the base of which is often concealed by the mountains in front of them. This makes it difficult to fix the snow-line with precision, but according to the most accurate estimate it is 9190 feet, or nearly that of Mount Canigou. Glaciers are not numerous in the Pyrenees, and hence the torrents and rivers which rise in the chain are fed chiefly by springs. Those on the south side flow towards the Ebro, and are carried by it to the Mediterranean; those on the north side flow partly to the Mediterranean and partly to the Atlantic, the water-shed between the two seas being carried northward by a branch which ultimately links with the Cevennes. The largest river of the chain, and the only one of importance which preserves its name throughout its whole course, is the Garonne. In respect of average height and mass the Pyrenees is unquestionably the second mountain chain of Europe, but its culminating point, Maladetta, has only the third place, being indeed lower than Mulhacen in the Sierra Nevada. Contrary to the general rule, that the loftiest summits of mountain chains are found in the line of the principal axis, Maladetta, Posets (11,047 feet), and Mont Perdu, the three culminating points of the Pyrenees, are situated on the south slope.

PYRENEES, PEACE OF THE, concluded between France and Spain by Mazarin and De Haro, on the Isle of Pheasants, in the river Bidasson, on the borders of the two countries, 7th November, 1659. By this treaty Spain ceded to France Roussillon, with the fortress of Perpignan, Conflans, and a part of the Cerdagne, so that the Pyrenees have since formed the boundary of the two kingdoms; and in the Netherlands, Artois, and part of Flanders, Hainault, and Luxemburg, with the fortified towns of Arras, Hesdin, Gravelines, Landreecy, Quesnoy, Thionville, Montmédy, Marienburg, and Philippeville.

PYRÉNÉES, BASSES-, a department of France, in the south-west, bounded on the north by Gers and Landes, on the west by the Bay of Biscay and Spain, on the south by the Pyrenees, and on the east by the department Hautes-Pyrénées; area, 2913 square miles. It consists of the lower slopes of the Pyrenees, which extend from the south with a general slope north-west. The surface is finely diversified and often very picturesque. The Pyrenees, shutting in the department on the south, and remaining long covered with snow, produce sudden changes of temperature, and send down cold winds, which often prove very injurious to vegetation after the season has far advanced. The soil is generally indifferent, and the ruggedness of the surface is very unfavourable to cultivation. Not much less than one-half of the whole surface is waste, and little more than one-fifth arable. The most valuable products are furnished by the extensive forests which clothe the mountain steepes; but maize, wheat, and flax, the last furnishing the material of the fine Béarn linens, are grown in the more favoured localities. Sheep, cattle, and swine are extensively reared, besides horses and mules. The chief minerals worked are copper, iron, lead, salt, &c., and the mineral springs are numerous. The department is divided into the arrondissements of Pau, Oloron, Orthez, Bayonne, and Mauléon. The capital is Pau. Pop. (1896), 421,955; (1901), 423,164.

PYRÉNÉES, HAUTES-, a department of France, in the south, bounded on the north by Gers, on the west by Basses-Pyrénées, on the south by the Pyrenees Mountains, and on the east by Haute-

Garonne; area, 1749 square miles. It is covered in the south with some of the loftiest summits of the Pyrenees, and even near its centre the Pic-du-Midi-de-Bigorre rises to the height of 9587 feet. The scenery is often very magnificent. The climate is very variable, and the surface, partly from the indifferent nature of the soil, but still more from its ruggedness, is ill adapted for cultivation. Little more than one-fifth of the whole is arable, and of this the larger part occurs on the beautiful plain of Bigorre. The vine is partially cultivated on the lower slopes, but the principal source of revenue is the extensive forests. The pastures are excellent, and rear horses, mules, asses, cattle, and swine. There are several important mineral springs. The arrondissements are Argelès, Bagnères-de-Bigorre, and Tarbes. The capital is Tarbes. Pop. (1896), 210,296; (1901), 212,173.

PYRÉNÉES-ORIENTALES, a department of France, in the south-east, bounded on the north by Aude, on the north-west by Ariège, on the south-west and south by Spain, and on the east by the Gulf of Lyons; area, 1592 square miles. On the south and west it is hemmed in by the chain of the Pyrenees, and traversed by ramifications forming parallel valleys, which stretch from west to east, and send their waters to the Mediterranean by the Agly, Tet, and Tech. The climate is on the whole excellent, though the winds are very inconstant, often suddenly succeeding each other, and blowing with equal violence from opposite directions. Nearly a half of the whole surface is waste, and the arable portion, which is less than a fourth, is by no means naturally fertile. Astonishing results, however, are produced by irrigation, particularly on the lower grounds where it can be most successfully applied, and heavy crops of wheat and maize, and luxuriant cuttings of lucerne, are obtained. By means of the latter large numbers of live stock are maintained. The vine is cultivated to some extent, and produces, among other wines of good name, that of Roussillon. The only important mineral is iron, which is extensively smelted and manufactured. There are three arrondissements: Céret, Prades, and Perpignan. The capital is Perpignan. Pop. (1896), 206,553; (1901), 209,447.

PYRHELIOMETER, an instrument for measuring the intensity of the heat of the sun. A shallow, circular vessel of silver, having one side coated with lampblack, containing mercury or water, and having a thermometer let into it, is the pyrheliometer of M. Pouillet. Suppose the apparatus to have the temperature t of the atmosphere; let it indicate t' after five minutes' exposure of the blackened side to the clear sky, the instrument being in the shade; let T be the temperature after five minutes' exposure of the blackened side to the direct rays of the sun, and T' the indication after another five minutes in the shade. The total effect E of the sun is given by—

$$E = T - t' + \frac{t' - t' + T - T'}{2}.$$

$E - t'$ is the apparent elevation of temperature after five minutes of direct sun, and $\frac{t' - t' + T - T'}{2}$ is the mean radiation during that five minutes. From E may be calculated the quantity of heat received by the mass in the ordinary heat units, by taking into account the specific heats of the silver and mercury; the area of the exposed surface is known, and thus the heating effect of the sun on a given area may be determined.

PYRIDINE (C_5H_5N), a mobile liquid, boiling at 117° , obtained by the distillation of various organic substances, such as peat, bone, coal naphtha, &c.

Pyridine has an alkaline reaction, and forms salts with acids.

PYRITES, a name given in mineralogy to various metallic sulphides, chiefly to the sulphides of copper and iron. Pyrites is largely used as a source of sulphur in the manufacture of sulphuric acid. See the articles COPPER, IRON, and SULPHUR.

PYRITZ, an ancient town of Prussia, in the government of Stettin, and 24 miles south-east of the town of that name, on an affluent of the Płon. The town was a place of great strength under the Wends, by whom five high towers standing on the town-walls were built. Pyritz has several courts and public offices, two churches, a town-house, and three hospitals; a fishery, and a trade in cattle. Near it is a fountain, in which in 1124 Otho of Bamberg is said to have baptized 7000 Pomeranians. Pop. 8244

PYRMONT. See WALDECK AND PYRMONT.

PYRMONT, a celebrated watering-place of Prussia, in the Principality of Waldeck and Pyrmont, capital of the district, in a beautiful valley at the foot of a range of finely-wooded hills, on the left bank of the Emmer, 34 miles s.s.w. of Hanover. It is a small but well-built place, with several fine promenades, and consists of an open square and a long street lined with linden-trees. It contains a palace, in which the Prince of Waldeck and Pyrmont resides during the watering season; and a very complete bathing establishment, which is much frequented, particularly by the aristocracy of Germany; from 10,000 to 12,000 visitors resort hither annually. The water is chalybeate, possessing valuable medicinal properties; it is strongly impregnated with carbonic acid gas, and produces an exhilarating and even intoxicating effect. About 55,000 bottles of water are annually exported. One of the curiosities of the place is the Dunsthöhle or gas grotto, which emits vapours similar in nature and effect to those of the Grotto del Cane in Italy. The bathing establishment has the usual accompaniments of theatre, ball-rooms, &c. Pop. 1500

PYROLIGNEOUS ACID, an impure acetic acid obtained by the distillation of wood. The wood is heated in large iron cylinders connected with a series of condensing vessels. The liquid which collects in these vessels is composed of tar, water, wood-spirit or methylic alcohol, acetic acid, &c. The watery liquid is separated and redistilled, when the wood-spirit passes over first, and the pyroligneous acid at a later stage of the distillation. For the method of purifying this crude acid see VINEGAR.

PYROMETER, an instrument for measuring temperatures higher than the boiling-point of mercury (350° C.). Regnault and other careful experimenters employed the expansion of air and vapours in measuring high temperatures. These pyrometers can only be employed in a laboratory; for use in a manufactory less accurate methods of measurement have to be employed. In Wedgwood's pyrometer (1782) it was assumed that dry clay, when exposed to heat, contracted regularly, and the instrument was constructed on this principle; but it is now known to be untrustworthy. An instrument in which the expansion of a metal bar (generally of platinum) was magnified by means of levers has often been employed to measure the temperature of a furnace. Morveau, Brongniart, and Daniell invented instruments on this principle. The thermo-electric law of Professor Tait may be used to calculate the temperature to which a junction of copper and iron has been subjected, the electric current produced being measured by a galvanometer. The author has in this way been able to measure high temperatures with considerable accuracy. Mr. Siemens measures temperatures by observing the increased electric resistance of a platinum wire when it becomes heated.

Two coils of the same kind of wire are prepared so as to have equal resistances at the same temperature. Their ends are connected by pretty long thick copper wires, and the current from a constant battery passing through them is measured by means of a galvanometer. One of the coils is kept at a known temperature, the other has the temperature which we want to measure. The law discovered by Mr. Siemens—

$$R = \alpha \sqrt{T} + \beta T + \gamma$$

where R is the resistance at the *absolute* temperature T , and where α , β , and γ are certain numbers, enables the temperature to be calculated. Pouillet determined the following temperatures by means of an air thermometer. They correspond to the stages of incandescence of a metal bar.

Incipient red-heat,	525° C.
Dull red,	700°
Cherry red,	900°
Dark orange,	1100°
White,	1300°
Dazzling white,	1500°

PYROPHORUS, a name applied to certain substances which take fire when exposed to the air. The most common pyrophorus consists of finely-divided metallic lead or iron, produced by heating the tartrate of these metals in a glass tube in a stream of coal-gas or of hydrogen, whereby the salt is decomposed, and the metal is left in the tube in a very finely-divided state. The tube is sealed while filled with coal-gas. On breaking open the tube and shaking its contents into the air, or into a jar of oxygen, the particles of the metal are oxidized, with evolution of heat and light.

PYROSOMA, a genus of animals belonging to the Tunicata (see MOLLUSCA—Tunicata) forming the type of the family Pyrosomidae, and included among the free-swimming or oceanic members of the Tunicate class. *Pyrosoma* is a *compound* organism, and consists of an elongated cylindrical tube closed at one extremity, and formed by the aggregation of an immense number of zooids or individuals. The branchial apertures open externally, the atrial orifices opening in the interior of the cylinder. The name *Pyrosoma* ('fire-body') is derived from the brilliant phosphorescent light emitted by these forms, the *Pyrosomæ* at night appearing each as a glowing lambent mass of flame. They chiefly occur swimming on the surface of the ocean in warm latitudes. Several species are known, of which *Pyrosoma atlanticum*, *P. elegans* of the Mediterranean, and *P. giganteum*, also found in the latter sea, are the most familiar. See also PHOSPHORESCENCE (ANIMAL).

PYROTECHNY, the term applied to the composition, structure, and use of artificial fire-works. The ingredients are nitre, sulphur, and charcoal, together with filings of iron, steel, copper, zinc, and resin, camphor, lycodium, &c. Gunpowder is used either in grain, half crushed, or finely ground, according to the desired effect. The proportions of the materials differ very much in different fire-works, and the utmost care and precaution are necessary when working them into a state fit for use, and then in the mixing. The longer the iron-filings, the brighter red and white sparks they give. Steel-filings and cast-iron borings contain carbon, and give a more brilliant fire with wavy radiations. Copper-filings give flame a greenish tint, those of zinc a fine blue colour; the sulphuret of antimony gives a less greenish blue than zinc, but with much smoke; amber, resin, and common salt (which must be very dry) give a yellow fire. Lampblack produces a very red colour with gunpowder, and a pink with nitre in excess. It serves for making golden showers; yellow micaceous sand serves for the same purpose. Verdigris imparts a

pale green, sulphate of copper and sal-ammoniac a palm-tree green. Camphor produces a very white flame, with aromatic perfumes, which mask the bad smell of the other ingredients; benzoin and storax are also used on account of their agreeable odour. Lycopodium, which is often used in the manufacture of stage-lightning, burns with a rose colour and a magnificent flame. For full information as to the various processes in the manufacture of fire-works see Dr. Ure's Dictionary of Arts and Manufactures, &c.

PYROXYLIC SPIRIT, a common name for methylic alcohol or wood-spirit. See METHYL.

PYRRHA. See DEUCALION.

PYRRHIC DANCE, one of the most famous war-dances of antiquity. It was danced to the sound of the flute, and its time was very quick and light, as may be seen from the nature of the Pyrrhic foot. (See RHYTHM.) In the Doric states it was as much performed for the purpose of military training as for amusement. We learn from Plato that its aim was to represent the rapid motions of soldiers avoiding missiles or blows, darting upon or from the enemy. In the non-Doric states it was purely a mimetic dance, and frequently performed by women. It was introduced into the Roman public games by Julius Caesar, and was danced by male and female dancers, having much of a dramatic character. In the mountainous districts of Thessaly and Macedonia a dance called the Romaika, which is supposed to be a modern relic of the Pyrrhic dance, is performed at the present day by men armed with muskets and swords.

PYRRHIC FOOT, or **PYRRHICHIUS**. See RHYTHM.

PYRRHO (Greek *Purhôn*), a Grecian philosopher of Elis, founder of the Pyrrhonian or ancient sceptical school, flourished about 340 B.C., and was probably born about the 101st Olympiad. In his youth he studied the art of painting, but was early led to apply himself to philosophy by the writings of Democritus. We learn from Diogenes Laertius that he accompanied his master, Anaxarchus, to India, in the train of Alexander the Great. During this journey he became acquainted with the doctrines of the Brahmans, Magi, and other eastern philosophers. His doubts concerning positive knowledge (or his scepticism) were strengthened as he proceeded in his studies, until at length he came to hold all knowledge uncertain, and considered virtue alone as valuable. In all disputes his answer to his opponents was, 'What you say may, or may not, be true; I cannot decide;' and he taught in his school that truth could not be attained, and that we must be content to suspend our judgment on all subjects. He spent a great part of his life in solitude, and by abstaining from all decided opinions concerning moral and physical phenomena, he endeavoured to attain a state of tranquillity not to be affected by fear, joy, or sorrow. He bore corporal pains with great fortitude, and no danger could disturb his equanimity. In disputation he was distinguished for acuteness of argument and clearness of language. His countrymen made him high-priest, and exempted all philosophers from the payment of taxes. Pyrrho died in the ninetieth year of his age. The Athenians erected a statue in honour of him, and his countrymen raised a monument to his memory. His scepticism is easily accounted for. He early became acquainted with the system of Democritus, who held that except the immediate elements of bodies (atoms) nothing was real, and that all perception was subjective. He was confirmed in these views by the doctrines of Socrates, to whom, in his character, he bore a great resemblance. Cicero mentions him expressly among the disciples of Socrates, and his scepticism is allied to the irony of that philosopher. Led by his temperament and his manner

of life to esteem an uninterrupted tranquillity the great object of all philosophy, believing that nothing tended so much to destroy this quiet as the interminable disputes of the schools of the Dogmatists, and that uncertainty was increased by their contentions, he determined to seek in some other way the peace which he despaired of finding in dogmatical philosophy. This made him a sceptic. Pyrrho left no writings. His friend and scholar, Timon, first wrote on the subject of scepticism, but his writings are lost. It is only from the works of his later followers, particularly Sextus Empiricus, that we learn the principles of his school, or rather their mode of thinking, by which they strove rather to overthrow other philosophical structures than to build up one of their own. A disposition to doubt is often called, from this philosopher, *Pyrrhonism*.

PYRRHUS, King of Epirus, was born about 318 B.C. He was the son of Eacides, who traced his descent from Pyrrhus, son of Achilles; he was also connected with the royal family of Macedon, and seems to have been early possessed of the desire to rival the exploits of the conquerors who sprang from that house. His father having been deposed by his subjects, Pyrrhus was brought at the age of two years to Glaucias, king of the Taulantians, who educated him with his own children. Ten years later Glaucias marched into Epirus at the head of an army, and placed Pyrrhus on the throne. In the course of four or five years the young king was expelled, and went to the court of Antigonos, king of Syria, where he became the friend of his son, Demetrius Poliorcetes, whom he accompanied on the fatal campaign closed by the battle of Ipsus (301 B.C.), in which Antigonos fell and his army was defeated. Pyrrhus, who had fought with great bravery in the battle, then proceeded to Egypt as a hostage for Demetrius, and there married Antigone, daughter of Queen Berenice. With the aid of Ptolemy Soter he recovered his kingdom (296), agreeing to share the sovereignty with Neoptolemus, who had been king since his expulsion. Pyrrhus soon after had his colleague put to death, and succeeded by his daring courage, affability, and generosity in gaining the admiration of his soldiers and people. He made an attempt to conquer Macedonia, and did obtain a share of the throne with Lysimachus, but in 286 was driven out of the country after a reign of seven months. He thereupon returned to Epirus, where he reigned quietly for several years; but in 280 he passed over into Southern Italy at the head of a large army to assist the Tarentines, at their request, in their war against the Romans. The first battle in which the Roman legion met the Greek phalanx was fought near Heraclea, on the Siris; and the consul M. Valerius Laevinus was defeated by Pyrrhus, whose elephants played an important part in the conflict. The loss the victory entailed upon him was, however, very severe, and he made proposals of peace to the senate, which were rejected, chiefly in consequence of the spirited appeal of the old censor Appius Claudius. Pyrrhus advanced upon Rome, but finding his enemies still unwilling to treat, and considering himself too weak to attack the city, he returned, after having approached within 24 miles of it, to Tarentum, where he wintered. There he received the famous embassy, headed by Caius Fabricius, sent to negotiate for the release of the Roman prisoners. (See FABRICIUS.) In 279 he again defeated the Romans, under P. Decius Mus and P. Sulpicius Saverrio. He lost so heavily in the battle that he was glad to accept the offered truce, and passed with his army into Sicily, where for two years he assisted the Greeks against the Carthaginians. At first he met with brilliant success; but his attack upon Lilybæum having failed, he lost popularity

with the Greeks, and returned to Italy in the autumn of 276. The war was renewed, and ended in the following year with the total defeat of Pyrrhus by the Romans under Curius Dentatus, near Beneventum. He reached Epirus with a small remnant of his once splendid army. Nothing daunted by his losses, he again invaded Macedonia, and became its king a second time. He afterwards turned his arms against Sparta, but was driven from before the walls of that city. In a night attack he made upon Argos he was stunned and dismounted by a tile thrown by a woman from the house-top, and being recognized by the enemy's soldiers was quickly despatched, 272 B.C.

PYTHAGORAS, a Grecian philosopher, founder of the Italian school. According to the most received opinion, he was a native of Samos. His father, Mnesarchos, was a merchant (probably of Tyre or some other Phœnician city), who traded to Samos, where he received the rights of citizenship, and settled with his family. The year of Pythagoras's birth is uncertain; probably it took place about 584 or 586 B.C. His history is mingled with many fables. He received his first instruction from Creophilus in his native city. He then went to the island of Scyros, and was a scholar of Pherecydes till the death of the latter; others make him also a scholar of Thales and Anaximander. Iamblichus says that Pythagoras, during his journey to Egypt, spent some time in Phœnicia in intercourse with the successors of Moschus, and other priests of the country, by whom he was initiated into their mysteries, and that he travelled through various parts of Syria in order to become acquainted with the most important religious usages and doctrines. But this account is blended with many fabulous circumstances. Pythagoras is said to have been recommended by Polycrates, king of Samos, to the Egyptian king Amasis. In Egypt he was probably initiated into the mysteries of the priests, and became acquainted with the whole range of Egyptian learning. He remained in Memphis and Thebes twenty-two years (547-525), and was still in Egypt when that country was conquered by Cambyses. Like many other of the sages in that kingdom, he was carried captive to Babylon, where he enjoyed the intercourse of the Persian and Chaldean Magi; and is said to have travelled as far as India, and visited the Gymnosophists. After his return he opened a school at Samos, in which he taught his doctrines in a symbolic form, in imitation of the Egyptians. Tradition, moreover, relates that he went to Delos, and received from the priestess Themistoclea moral maxims, which he communicated to his disciples under the name of *divine precepts*. He also visited Crete, where the priests of Cybele took him to the caverns of Ida, in which Jupiter had been cradled. Here he met Epimenides, who boasted of having intercourse with gods and the gift of prophecy, and whom he initiated into the sacred mysteries of the Greeks. From Crete he is said to have gone to Sparta and Elis, and from thence to Philus, where, being asked by King Leon what was his profession, he replied that he was a philosopher (or lover of wisdom), declaring that the name of sage (*sophos*) belonged solely to the Divinity. With augmented knowledge he returned home, where he now founded a philosophical school with great success. His doctrines seemed divine oracles; and the sacred obscurity in which he had the art of veiling them attracted a great number of disciples. He resolved, nevertheless, to leave Samos, either to avoid the public offices conferred upon him or the tyranny of Polycrates, and went to Magna Græcia. He eventually settled at Crotona, attracted, as Grote supposes, by the celebrity of that city for the cultivation of the art of

medicine. From all traditions it may be concluded that he laid claim to supernatural powers, and his extraordinary qualities gained over great numbers to enter into his views. His adherents belonged to the noble and wealthy classes. Three hundred of these were formed into a select fraternity or order, which has been frequently compared with the still more famous order founded by Loyola in modern times. The members were bound by a vow to Pythagoras and each other, for the purpose of cultivating the religious rites and ascetic observances of their master, and of studying his system of philosophy. They thus formed at once a philosophical school and a religious order, which in time assumed the character and exercised the influence of a political association also. This influence, which became very considerable, was constantly exerted in the interest of the aristocratic party. The democratic party (perhaps, also, at times, an unfriendly aristocratic faction) reacted against the growing power of the order. At the head of this opposition party in Crotona was Cylon, a rich and respectable citizen, whose enmity Pythagoras had excited by refusing to receive him among his scholars. In revenge Cylon once attacked the house of Milo, where a number of Pythagoreans were assembled, surrounded it with his partisans, and set it on fire. Forty persons perished, and but few escaped. Pythagoras was probably not in the house. Other authorities set down this event long after the death of Pythagoras, who, they say, was simply banished by Cylon to Metapontum. He fled to the Locrians, and when these refused to receive him, to Metapontum, where, according to tradition, he perished from want of sustenance, eighty years of age (about 506 B.C.) His scholars are said to have paid him divine honours after his death. He is said to have asserted that his soul had already lived in several bodies, among others those of Euphorbus, a Trojan hero, of a courtesan, and a poor fisherman. In public he appeared in the oriental costume, in a long white robe, with a flowing beard, and, as some say, with a crown of gold on his head. His exterior, was grave, commanding, and dignified. He abstained, it is related, from all animal food, and limited himself to vegetables, not, however, eating beans. To show his respect for marriage he took a wife at Crotona, by whom, among several children, he had two sons, Telanges and Mnesarchus, who were his scholars and successors. That Pythagoras left any works is improbable on the testimony of the ancients. The Golden Sentences, extant under his name, which may be considered as a short abridgment of his popular doctrines, appear to have been composed by later hands. Like those of the Egyptian priests, his doctrines were of two kinds, public and secret. His public instruction consisted of practical discourses, in which he recommended virtue and dissuaded from vice, with a particular reference to the various relations of mankind, such as those of husbands and wives, parents and children, citizens and magistrates, &c. His hearers at these lectures must not be confounded with the members of his society, whom he subjected to a separate discipline, and not till after long instruction and severe examination admitted to all the mysteries of his secret doctrines. These scholars were required to practise the greatest purity and simplicity of manners. He imposed upon them, it is said, but on no good authority, a silence of two to five years, according to circumstances (the Pythagorean silence). For a time the disciples were only hearers. The well-known 'He said so' (*autos epha—ipse dixit*) was sufficient authority, without any proof. He alone who had passed through the appointed series of severe trials was allowed to hear the word of the master in his immediate presence. Whoever was terrified by the difficulties might with-

draw without opposition, and his contributions to the common stock were repaid, a tomb was erected to him as if he were dead, and he was no more thought of. To the members of the secret society the doctrines were not delivered, as to others, under the mask of images and symbols, but unveiled. These secrets probably related to religious and political subjects. It was requisite, however, to take an oath of secrecy. The pupils could now interrogate and make objections. They were called, by way of distinction, *Pythagoreans*. As soon as his disciples had made sufficient progress in geometry they were introduced to the study of nature, to the investigation of fundamental principles, and to the knowledge of God. Others, according to their inclinations and capacities, were instructed in morals, economics, or politics, and afterwards employed either in managing the affairs of the society, or sent abroad to inculcate and bring into practice the principles of philosophy and government in the other Grecian cities. According to the accounts of later writers, the mode of living at the Pythagorean school at Crotona was the following: The Pythagoreans, with their wives and children, lived together in a public building, in perfect harmony, as if one family. Each morning it was decided how the day should be spent, and every evening a review was made of all that had been done. They rose before the sun, in order to worship it; verses from Homer and other poets were then recited, or music was introduced, to rouse the mental powers, and fit them for the duties of the day. Several hours were then spent in serious study. A pause followed for recreation, in which a solitary walk was usually taken, to indulge in contemplation; a conversation then took place. Before dinner various gymnastic exercises were performed. The common meal consisted principally of bread, honey, and water. The remainder of the day was devoted to public and domestic affairs, conversation, bathing, and religious performances. After the destruction of the association, and the flight of his scholars from Lower Italy, Lysis and Archippus deemed it necessary to collect the doctrines of their master in a systematic treatise, and preserve them from oblivion; but the greatest secrecy was nevertheless recommended.

Among the authorities for the doctrines of Pythagoras or his immediate followers the indications furnished by Aristotle are the most important. Of still greater value for our knowledge of the Pythagorean system would be the fragments (collected by Bockh) of the work of Philolaus, a contemporary of Socrates, in case their authenticity were assured. All other pretended philosophical writings or fragments of writings by ancient Pythagoreans are spurious. The contents of the fragments attributed to Philolaus harmonize in many respects with the testimony of Aristotle, and give, besides, a much more concrete conception of the system; yet there is mingled with them much that is of later origin. Plato and Aristotle seem to have had no knowledge of any other than oral utterances of Philolaus. Only their statements, and in part those of the earlier Aristotelians, but no later ones, are trustworthy. Timon the Sillograph says that Plato bought at a high price a small book, on which he founded his dialogue *Timæus*; but it is doubtful what work is meant—probably a work of Archytas the Pythagorean. Hermippus says that this book was written by Philolaus. Under these circumstances it is impossible to discriminate with any degree of accuracy between the doctrines of the master and those of his scholars. Pythagoras resembled the philosophers of the Ionic school, who undertook to solve, by means of a single primordial principle, the problem of the origin and constitution of the universe as a whole. His predilection for

mathematical studies led him to trace the origin of all things to number, his theory being suggested, or at all events confirmed, by the observation of various numerical relations or analogies to them in the phenomena of the universe. Numbers are in his view the first and most essential of things. They are, as it were, the model according to which the world is formed in all parts. The odd numbers are limited and perfect; the even unlimited and imperfect. The *monad* or unity is the source of all numbers. The *dyad* is, according to the later Pythagorean doctrines, imperfect and passive, and the cause of increase and division. The *triad*, compounded of the monad and dyad, partakes of the nature of both. The *tetrad*, or number four, is in the highest degree perfect. The *decad*, which contains the sum of these four numbers, and is therefore called *tetractys*, comprehends all musical and arithmetical proportions, and denotes the system of the world. The real meaning of the Pythagorean doctrine of numbers is not well understood; numbers were probably in this system the symbolical or allegorical representations of the first principles or forms of nature. As Pythagoras could not express abstract ideas in simple language, he seems to have made use of numbers, as geometers do of a diagram, to assist the comprehension of his scholars. He perceived some analogies between numbers and the attributes of the divine understanding, and made the former the symbols of the latter. As the numbers proceed from the monad or unity, undergo various combinations, and in their progress assume new properties, so he regarded the pure and simple essence of the Deity as the common source of all the forms of nature, which, according to their various modifications, possess different properties. Pythagoras is also said to have invented the abacus, thence called the *Pythagorean table*. Next to numbers, music belonged to the preparatory exercises of the Pythagorean school, by which the mind was elevated above the dominion of passion, and fitted for contemplation. Pythagoras considered music not only as an art to be judged of by the ear, but as a science to be reduced to mathematical maxims and relations, and allied to astronomy. Tradition makes him the inventor of a musical instrument (Pythagorean lyre, *ortochordum Pythagoræ*), which, after his death, was engraved in brass, and preserved in the Temple of Hera at Samos. The invention of the harmonic canon or monochord, an instrument of a single string, which served for the measurement of musical intervals, has also been ascribed to him by ancient and modern writers. There is also a celebrated story of his having discovered the arithmetical relations of the musical scale by observing accidentally the various sounds produced by hammers of different weights striking upon an anvil, and suspending by strings weights equal to those of the different hammers. Those who retailed this story never took the trouble of verifying the experiment, or they would have found that hammers differing in weight striking on the same anvil no more produce tones higher or lower in pitch than do different clappers from one bell. He believed that the heavenly spheres in which the planets move, dividing the ether in their course, produced tones, and that the tones must be different according to their size, velocity, and distance. That these relations were in concord, that these tones produced the most perfect harmony (music of the spheres), he necessarily believed, in consequence of his notions of the supreme perfection of the universe. This harmony, however, we do not hear, either because we have been accustomed to it from the first, and have never had the opportunity of contrasting it with stillness, or because the sound is so loud as to exceed our capacities for hearing. Geometry, which he had learned

in Egypt, he reduced more than any of his predecessors and contemporaries to the form of a regular science. According to his notion the geometrical point was simple, the line double, the area threefold, and solids quadruple; and in this way also he applied the doctrine of numbers. Of the geometrical theorems which are ascribed to him the following are the most important:—The three angles of a triangle are together equal to two right angles, and in a right-angled triangle the square of the hypotenuse is equal to the sum of the squares of the two sides. This last is still called the *Pythagorean theorem* (also *magister mathematicos*), though it is doubtful whether Pythagoras discovered it. In astronomy he taught the following:—Agreeably to the arithmetical hypothesis there are ten heavenly spheres, of which nine are visible to us, namely, the sphere of the fixed stars, the seven spheres of the seven planets (including the sun and moon), and the sphere of the earth. The tenth sphere, called by him Antichthon (anti-earth), is invisible, but necessary to the perfection of the harmony of nature, since the decad is the perfection of the numerical harmony. By this anti-earth he explains the eclipses of the moon. In the middle of the universe is the central fire, the principle of warmth and life. The earth is one of the planets moving around the sphere of fire, and according to the later Pythagoreans revolving on its own axis also. The atmosphere of the earth is a gross immovable mass, but the ether is pure, clear, always in motion, and the region of all divine and immortal natures. The distances of the various heavenly spheres from the earth correspond to the proportions of the musical scale. His moon and stars are gods, or inhabited by gods. His disciples Philolaus, Archytas, Ecphantus, Ocellus, Timæus, carried these speculations farther. Philolaus in particular distinguished himself by his astronomical system. With mathematics were also connected the natural sciences. With respect to philosophy Pythagoras taught that true knowledge embraced those subjects which are in their nature immutable, eternal, and indestructible, and of which alone it can be properly predicated that they exist. He who devotes himself to this study is a philosopher. The object of philosophy is by contemplation to render the human mind similar to the divine, and make it fit to enter the assembly of the gods. For this purpose it is necessary to invoke in prayer the assistance of the divinity and good dæmons. Contemplative wisdom cannot be fully attained without entire abstraction from common things, without entire tranquillity, and freedom of mind. Hence the necessity of founding a society separate from the world for contemplation and study. The theoretical philosophy of Pythagoras, which treats of nature and its origin, was enveloped in the most profound obscurity, and we know nothing of it but what may be conjectured from single intimations of the ancients. In the opinion of Pythagoras God is the universal spirit, diffused in all directions from the centre, the source of all animal life, the actual and inward cause of all motion, in substance similar to light, the first principle of the universe, incapable of suffering, invisible, indestructible, and to be comprehended by the mind alone. To the Divinity there were subordinate, according to the notions of the Pythagoreans, three kinds of intelligences—gods, dæmons, and heroes, emanations of the supreme God, varying in dignity and perfection in proportion as they were more or less removed from their source. The heroes he believed to be clothed with a body of subtle matter. Besides these three kinds there was a fourth—the human mind, likewise an emanation of the Divinity. As God is one, and the origin of all variety, he was represented as a monad, and the

subordinate spirits as numbers derived from and contained in unity. Thus the numbers of Pythagoras resembled the ideas of Plato, excepting that they are contained in the things themselves. The regions of the air the Pythagoreans thought filled with spirits, dæmons, and heroes, who were the cause of health or sickness to men and animals, and by means of dreams and other kinds of divinations imparted the knowledge of future events. The soul, according to him, was likewise a number, and by numbers it first has perception, as Philolaus says, of the world; it is an emanation of the central fire, and consequently always in motion and indestructible. Of man the Pythagoreans believed, at least the later, that since he consisted of an elementary nature, of a divine or rational principle, he was a microcosm; that his soul was a self-moving principle, and consisted of three elements—Reason, an emanation of the central fire; and Intelligence and Passion; the first being distinctive of man, the two last being common to man and brutes; that the sensitive soul (*thumos*) perishes, but that the rational mind (*phrenes, nous*) is immortal, because it has its origin in an immortal source; that the latter, when freed from the fetters of the body, assumes an ethereal vehicle, and passes to the habitations of the dead, where it remains till it returns to the world to dwell in some other human or animal body. Souls under the dominion of sensuality either passed into the bodies of animals, or were cast down to Tartarus to meet with expiation or condign punishment. The pure were exalted to higher modes of life, and at last attained to incorporeal existence, being merged in the source from which it proceeded. This doctrine of the transmigration of souls (metempsychosis), which was originally Egyptian, and connected with the idea of the reward and punishment of human actions, was the chief cause why the Pythagoreans killed no animals. His morality Pythagoras taught in symbolic maxims and ascetic precepts in connection with his contemplative views. Virtue was regarded as a harmony of the soul, a conformity with or an approximation to God; self-restraint, sincerity, and purity of heart were especially commended; and conscientiousness and uprightness would seem to have been the characteristics of the earlier Pythagoreans. The Pythagorean philosophy had a great influence on the Platonic. In later times it was revived and intermingled with Neo-Platonism. See *Geschichte der Pythagoräischen Philosophie*, by Ritter; *Lewes's Biographical History of Philosophy*; *Grote's Greece*; *Zeller's Pre-Socratic Schools*; &c.

PYTHEAS, a native of the Greek colony of Massilia, now the French Marseilles, is supposed to have lived about the time of Alexander the Great or a little later, and acquired great celebrity as a navigator, though the loss of his works, and the short and ambiguous accounts furnished by others, especially Strabo and Pliny, make it very difficult to determine the extent of his merits. Two principal voyages are ascribed to him. In the one he sailed along the west coast of Europe, entered the English Channel, landed, and travelled to some distance in Britain, and then continuing his course northward, after six days' sail north of Britain, arrived at Thule, where, during the summer solstice, the sun never disappears. This description seems to make Thule identical with Iceland. He was prevented from proceeding farther, apparently by dense fogs, which, in the fabulous spirit of his age, he has described in a manner which has been allowed to throw too much discredit on his general statement. He says that at Thule there was neither land, air, nor sea, but something compounded of them all—a molluscous substance in which earth, sea, and the whole universe were suspended. His second voyage proceeded, like his first, along the west

coast of Europe, and then through the English Channel into the German Ocean; but instead of afterwards continuing northward he appears to have crossed over to the coast of Denmark, and found his way into the Baltic, where he proceeded as far as a river which he called Tanais (which cannot be identified), and on the banks of which amber was found. Pytheas had the reputation of being a good mathematician, and is said to have determined the sun's meridian altitude at Marseilles at the summer solstice by means of a gnomon or sun-dial.

PYTHIAN GAMES, one of the four great Grecian games, instituted in early times in honour of Apollo, the conqueror of the Python. They were celebrated in the neighbourhood of Delphi (formerly called Pytho), in the Crissean fields, which for this purpose contained a hippodrome or race-course; a stadium of 1000 feet in length; and a theatre, in which the musical contests took place. According to the popular mythological legend the Pythian Games were instituted by Apollo himself. They seem to have been originally only a musical contest, which consisted in singing a hymn to the accompaniment of the cithara, in praise of the Pythian god. Until about 586 B.C. they were under the management of the Delphians, and took place at the end of every eighth year; but after that date they were conducted by the Amphictyons, and were celebrated at the end of every fourth year, and prizes were added for flute-playing, athletic sports, and horse and chariot racing. Eventually contests in tragedy and other kinds of poetry, painting, sculpture, and historical narratives were introduced. At first the prizes were silver or gold, but afterwards they consisted of the laurel wreath and the symbolic palm-branch. The statues of the victors were, besides, erected in the Crissean plain. They continued to be celebrated, it is believed, until the end of the fourth century of our era.

PYTHON, a genus of Serpents included in the family Boidea. This family belongs to the sub-order of Colubrine Snakes, and to the Innocuous or Harmless section of that sub-order, in the members of which the upper jaw is provided with solid teeth only, fangs and a poison apparatus being absent. The Pythons belong exclusively to the Old World, and are very nearly related to the Boas, which occur in both hemispheres. They are serpents of enormous size, the typical genus *Python*, the species of which possess teeth in the intermaxillary bones, being found chiefly in India and in the islands of the Eastern Archipelago. These snakes may possess more than 400 vertebrae, and frequently attain a length of 30 feet, even a greater length may sometimes be attained. The tail is eminently prehensile, and possesses two rows of plates on its under surface. There are deeply indented or pitted plates about the jaws. A rudimentary pelvis and traces of hinder limbs exist in the Pythons, these structures terminating externally in a kind of hooked claw. The head is of triangular conformation, and exceeds the neck in thickness. The mouth is extremely large, and the gape very wide.

Although destitute of any venomous qualities, these snakes are greatly dreaded on account of their enormous strength, which is brought into requisition in the capture of their prey. Aided by their prehensile tails and rudimentary hinder limbs, the Pythons suspend themselves from the branches of trees, generally in the neighbourhood of water, and lie in wait ready to pounce upon animals which come to drink. The body is then wound round the victim, which is thus crushed into a shapeless mass by the powerful constricting folds of the snake. Stories of the huge bulk of which these serpents are able to

swallow have been from time to time circulated, and although there may be good reason to doubt the capability of the largest python to swallow the body of an animal the size of a buffalo, there can nevertheless be no doubt that a goat or sheep can readily be disposed of. A variety of circumstances assist in the deglutition of prey of relatively large bulk by the Pythons. Thus, firstly, the body of the victim is primarily crushed into a shapeless pliant mass by the serpent itself. Then, secondly, its body is said to be smeared over by the glutinous or viscid saliva of the snake, so as to lubricate the mass and assist its deglutition. The teeth of these serpents are simply conical recurved structures, which, whilst useless for mastication, will tend to fix and retain the prey in the mouth, and prevent its egress during the movements of swallowing. And lastly, the mandibles or jaws may, through the loose and disjointed arrangement of the squamosal and quadrate bones, be very widely separated from the skull, so as to largely increase the size of the mouth from above downwards; whilst the halves of the lower jaw being but loosely connected by elastic ligaments, the cavity of the mouth can thus be greatly enlarged from side to side also. The throat is also exceedingly distensible, and from a consideration of the foregoing points it is easy to conceive how the bodies of even large animals may be slowly and gradually swallowed.

From observations on a female python (*Python bivittatus*) kept in France, eggs which were deposited on the 5th May, 1841, were hatched after fifty-six days of incubation, the young being mostly free from the eggs on the 3d July, whilst the last appeared on the 7th of that month. Only eight out of fifteen eggs, however, came to maturity. The mother took no nourishment during the entire period of incubation, but drank water on the twentieth day, and first ate on the 3d of July. The temperature of the mother's body while incubating rose to 73° Fahr., the temperature of the cage being about 50° only. The young drank water on coming from the shell, but did not eat until after they had cast or exuviated their first skin, an event which occurred between the tenth and fourteenth day of their existence. A female python of the species *P. saba* deposited eggs in the reptile house of the London Zoological Society in January, 1862, and during the incubatory period, when, as is the fashion of these snakes, the body of the female is coiled up around the eggs, the heat of the python's body was found to be from 6° to 20° greater than the temperature of the male, which was contained within the same cage.

The genus *Python* contains various species, the best known of which are the Royal Python (*Python regius*), the West African Python (*P. sebae*), and the Reticulated Python (*P. reticulatus*). A South African species, described by Dr. Smith, is known under the designation of *Python Natalensis*. Fossil remains of a snake allied to the Pythons and Boa-constrictors, and which attained a length of about 12 feet, occur in the London clay of Sheppey (Lower Eocene). This form is named the *Palaeophis toliapicus*, and the nearly-allied *P. typharus* of the (Middle) Eocene beds of Bracklesham must have attained a length of nearly 20 feet.

PYX (Greek, *pyxis*, a box).—1. The caskets in which the ladies of ancient times kept their jewelry. They were made of gold, silver, ivory, mother-of-pearl, tortoise-shell, &c., and were often finely ornamented with sculpture. 2. The sacred vessel used in the Catholic Church to contain the host. In ancient times it sometimes had the form of a dove, and was suspended above the altar. It was, however, generally of a rectangular shape, and frequently made of gold or silver, or of a baser metal plated with these. They

are now cylindrical, cup or bell shaped, with a cross-surmounted cover of the same material. They are frequently delicately chased and inlaid.

PYX, TRIAL OF THE, the official mode of ascertaining by weight and assay if the gold and silver coins issued from the Mint are of the standard weight and fineness. The trial takes its name from the Mint pyxes or strong boxes, two in number, one for gold and one for silver coins, and which contain trial plates or standard pieces having the exact percentages of alloy to render them sterling gold and silver, also other pieces of the exact weights of the several denominations of coins. The investigation takes place by a jury of goldsmiths summoned by the lord-chancellor. A few coins are taken from each day's melting, wrapped in paper, and put into one or other of the boxes. From time to time some of these are tested by the Mint authorities themselves for their

own guidance and satisfaction; but the official trial takes place less frequently. For this a definite number of pieces are taken from each box, and after being each carefully weighed, are cast into ingots; these ingots are tested with rigorous accuracy to test if the metal correspond with the sterling pieces. If the coins are found to be correct within the small 'remedy' (see COINAGE), or margin of error allowed to the Mint-master, the test is accepted as conclusive, and the authorities of the Mint relieved from all responsibility. By 33 and 34 Vict. cap. x. (1870) the trial of the pyx is ordered to be held once a year, and the king in council is empowered to issue orders as to the mode of holding it. The place where the meeting to make the test is held is generally Goldsmiths' Hall; and the trial pieces and standard weights have been transferred from the custody of the Exchequer to that of the Board of Trade.

Q.

Q, the seventeenth letter in the English alphabet, and one of the surds or mutes. The ancient Latins had not this letter, but wrote *obliquus*, *locuntur*, not *obliquus*, *loquuntur*; and after it was introduced among the Romans, it was considered by some, not as a letter, but as a character expressing two letters; hence some wrote *qis*, *qæret*, *qid*, while others preferred *cuis*, *cuarret*, *cuid*. The letter was borrowed from the Phœnician by the Greeks in early times, but latterly with them it was used only as a number (= 90), being placed between their *p* (= 80) and *r* (= 100), and having the name *Koppa*. It may be considered as a superfluous character; and in the oldest form of our alphabet (that in use among the Anglo-Saxons) there was no *q*, the sound of *qu* being represented by *cw*, as it might very well still be, or else by *kw*, for the regular sound of *qu* in English is that of *k* with the consonant *w* sound following it. In the other Teutonic tongues it is sparingly used or not at all. In French and Spanish, which have no *k*, it has been retained in the alphabet only to express this sound by the assistance of *u*. In Italian it is pronounced as in English. In words derived from the French it may sound merely as *k*, as in *oblique*, *pique*. **Q**, as a Roman numeral, signified 500; with a dash over it, 500,000. **Q**, as a Latin abbreviation, stands for *Quintus*, *quæstor*, *quartus*, *que* (as in the famous *S.P.Q.R.*, *senatus populusque Romanus*, the Roman senate and people), *quod*, &c. In modern abbreviations it stands for *question*, *queen*, &c.

QUADI, an ancient Teutonic tribe whose territory was on the Danube, extending to the Theiss on the east and to the Carpathian Mountains on the north. They leagued themselves with their powerful neighbours the Marcomanni, and waged destructive wars with the Romans, particularly during the reign of Marcus Aurelius. They cease to be heard of in the fifth century, having probably migrated farther west with the Suevi.

QUADRAGESIMA, a Latin word signifying fortieth, and used to denote the forty days of fast (Lent) preceding Easter. Quadragesima Sunday is the first Sunday in Lent. See LENT.

QUADRANT, an instrument which used to be employed by astronomers in determining altitudes. It consisted of a brass limb, the quarter of the circumference of a circle, divided into 90°. Glasses attached to a straight rod, or in better instruments

a telescope, enabled a heavenly body to be seen. The plane of the quadrant and the plane of motion of the telescope coincided with the meridian. The angle which the line of sight of the telescope made with a vertical line at the place of observation was measured on the quadrantal limb. The zero of measurement, or the reading of the vertical line on the limb, was carefully determined in the fixed instruments; in movable instruments a plumb-line was used to mark the zero during an observation. The difficulty of constructing an accurate instrument and of correcting observations led to the introduction of limbs which are complete circumferences of circles, so that at present the quadrant is not in use. The movable quadrant used to be employed at sea, but its place is now supplied by the sextant (which see).

QUADRANT ELECTROMETER, an instrument constructed by Sir William Thomson (Lord Kelvin) to measure with great accuracy small charges of electricity. It is of very great importance to telegraphic engineers and experimental physicists. See ELECTROMETER.

QUADRATE BONE, the bone developed in Reptiles and Birds, by means of which the lower jaw is articulated or joined to the skull. The lower jaw of these forms is thus not articulated directly or of itself to the skull, as in Mammals; and in Reptiles and Birds each half of the lower jaw is composed of a number of distinct pieces. In Mammals, on the contrary, the lower jaw consists simply of two halves united together in front. The *os quadratum* or *quadrate bone*, which thus forms a characteristic structure of Birds and Reptiles, is generally regarded as corresponding in Mammals to one of the little bones or *auditory ossicles* of the internal ear, named the *malleus*. See EAR.

QUADRATIC EQUATIONS. See EQUATION.

QUADRATURE. In astronomy, the moon or a planet is said to be in quadrature when its longitude differs from that of the sun by 90°.

QUADRILLE, a dance of French origin, but now popular in most civilized countries of the globe, and which consists generally of five consecutive figures or dance movements, danced by four couples, each forming the side of a square; or by four sets (often pairs) of couples.

QUADRILLE, a game at cards, played, as its name implies, by four persons. It is played with a

pack of forty cards, the eight, nine, and ten of each suit being thrown aside. The deal is made by distributing the cards to each player three at a time for two rounds, and four for one round, commencing with the *right* hand player—the elder hand. It is best simply to cut between the deals without shuffling. The rank and order of the cards *when trumps* are as follows: 1st, Ace of spades, which, whatever be the trump suit, is always ranked as the best trump card, and is called *spadille*; 2d, that which would be the lowest card if the suit were not trumps (the seven if red and the two if black); this is called *manille*; 3d, ace of clubs, which, whatever be the trump suit, always ranks as the third best card, and is called *basto*; 4th, *ponto*, the ace of trumps, if the suit is red, if black there can be no *ponto*. After this, if the suit is red, come king, queen, knave, two, three, four, five, six (lowest); if black, king, queen, knave, seven, six, five, four, three (lowest). For suits *not trumps* the rank and order are: Red suits, king, queen, knave, ace, two, three, four, five, six, seven (lowest); black suits, king, queen, knave, seven, six, five, four, three, two (lowest). It will thus be seen that the red suits have one trump more than the black, the former having twelve and the latter only eleven. The three best trump cards, namely, *spadille*, *manille*, and *basto*, are called *matadores*, or shortly *mata*, and have the privilege that the holder is not bound to follow suit with them when trumps are laid, except when the card laid is a superior *mat*, which forces a lower one if there is no other trump in the hand. The cards being dealt and examined, the elder hand, if he finds his hand weak, may *pass*, that is, decline to lead; the second player may do the same, and so on all round; in this case the elder hand must lead, choosing which suit shall be trumps (which, of course, will be that in which he finds he is strongest), and cards are laid and taken as in ordinary card games. He may, however, risk standing alone, in which case he at once commences the game by naming trumps and playing a card; in this case he has to take six tricks before he counts game; if he succeeds he obtains the whole of the winnings, but if he fails he pays the whole of the losses. He may open the game in a different way by 'asking leave' (to have a partner), which is done by naming his trump suit and calling for his partner, the player who holds the king of any suit, not trumps, which he chooses to name. The player who holds this card then knows that he is the partner chosen, but must not reveal this fact except through his play. The other two players of course know they are opponents, and regulate their play accordingly. The player who holds the king must play it when his turn arrives. The player who asks leave is called *l'hombre* (or in English *ombre*), and he and his 'friend' (partner)

win the game if they take six tricks, the gains being divided, and if they do not succeed in this they divide the losses. When six tricks are taken by either party the game may be continued if the winner or winners should choose to undertake all the ten tricks, which is called *vole*. If it is undertaken and not obtained the parties are subject to forfeits.

This game is complicated by a number of conditions which often modify the ordinary mode of playing. *Quadrille* was very popular and fashionable in England about the beginning of the century, but is now almost forgotten. *L'hombre*, the game celebrated by Pope in his *Rape of the Lock*, is essentially the same game, but played by three persons instead of four.

QUADRIVIUM (Latin, *quatuor*, four, and *via*, way), the name given by the schoolmen of the middle ages to the four mathematical branches of study, arithmetic, music, geometry, and astronomy, in contradistinction to the Trivium, which consisted of the three remaining branches taught in the mediæval schools, and which consisted of grammar, rhetoric, and dialectics, the whole comprehending what was called the seven liberal arts.

QUADRUMANA ('four-handed'), the name applied by Cuvier to denote the order of *Mammalia* represented by the Lemurs, Monkeys, and Apes, from the fact that these forms agree in possessing the *hallux* or great toe, constructed so as to be capable of opposing the other digits of the feet, instead of being placed parallel with the other toes, and adapted for supporting the foot on the ground. This conversion of the feet into 'hand-like' organs as it were, presented to Cuvier's mind so different and remarkable a structure from the disposition of the feet and toes of man, that he separated man as a sole and single genus to represent the distinct and opposing order of *Bimana* or 'two-handed' *Mammalia*. As mentioned in the article MAMMALIA, the classification of the highest *Mammals* has varied very considerably at various periods of scientific history. The *Primates* of *Jinnæus* thus included in one great division not only man and all *Quadrumana*, but also the *Cheiroptera* or Bats; whilst in more recent systems of arrangement the term *Primates* is applied to indicate the highest order of *Mammals*, represented by man, Apes, and Lemurs, but excluding the Bats. This latter arrangement receives countenance from a consideration of the purely anatomical or *structural* relations existing between man and the Apes. And in modern zoology the *Primates* are commonly subdivided into two great groups as follows; this classification, if we omit the first family (*Hominidæ*), including man (and representing the order *Bimana* of other arrangements), representing succinctly the various divisions of the great order *Quadrumana*.

ORDER—PRIMATES.

Sub-order I. — ANTHROPOIDEA.

Family I.—HOMINIDÆ (=BIMANA), Ex. *Homo*—Man.

Family II.—SIMIADÆ, includes...	Sub-family 1. <i>Simiina</i> (<i>Anthropida</i> , or 'Man-like Apes' of some arrangements),	Genera—ex. <i>Troglodytes</i> , ex. <i>Simia</i> , ex. <i>Hylobates</i> ,	{ Gorilla. Chimpansee. Orangs. Gibbons.
	Sub-family 2. <i>Semnopithecina</i>	Genera { ex. <i>Semnopithecus</i> , ex. <i>Colobus</i> , <i>Cercopithecus</i> , <i>Macacus</i> ,	{ Entellus Monkey. Guenons. Macaque Monkeys. Baboons and Mandrills.
	Sub-family 3. <i>Cynopithecina</i>	Genera { <i>Cynocephalus</i> , <i>Ateles</i> ,	{ Spider Monkeys. Sapajons. Capuchins. Howling Monkeys.
Family III.—CERCOIDÆ	Sub-family 1. <i>Cebina</i>	Genera { <i>Cebus</i> ,	{ Sakis.
	Sub-family 2. <i>Myecina</i>	Genus { <i>Myocetes</i> , <i>Pithecia</i> , <i>Brachyurus</i> ,	{ Squirrel Monkeys. Marmosets.
	Sub-family 3. <i>Pithecina</i>	Genera { <i>Callithrix</i> , <i>Chrysotrux</i> , <i>Nyctopithecus</i> ,	
	Sub-family 4. <i>Nyctipithecina</i>	Genera { <i>Nyctopithecus</i> ,	
	Sub-family 5. <i>Hapalina</i>	Genus { <i>Hapale</i> ,	

Sub-order II.—*LEMUROIDEA* (Lower Apes).

Family IV.— <i>LEMURIDÆ</i>	Sub-family 1. <i>Indrisina</i>	Genera {	Indria,	} Indria.
	Sub-family 2. <i>Lemurina</i>	Genera {	Lemur, Hapalemur, Lepilemur, Nycticebus,	
	Sub-family 3. <i>Nycticebina</i>	Genera {	Loria, Perodicticus, Arotocebus,	} Loris and Slow Lemura.
	Sub-family 4. <i>Galaginina</i>	Genera {	Cheirogaleus, Galago,	
Family V.— <i>TARSIDÆ</i> .....	.. .. .	Genus:	Tarsius—Tarniers.	
Family VI.— <i>CHEIROMYIDÆ</i> .....	.. .. .	Genus:	Cheiromys—Aye-Aye of Madagascar.	

As limited to the Apes, Monkeys, and Lemurs, the characters of the order *Quadrumanina* consist in the separation of the hallux or great toe from the other toes, and in its power of being opposed to the other toes, so as to convert the foot into a prehensile hand. The pollex or thumb may be wanting (as in *Colobus*), or very short (as in *Semnopithecus*); but when developed the thumb is also opposable to the other digits of the hand, and the animals thus become truly *quadrumanous* or 'four-handed.' The collar-bones are fully developed. The teats number two, the mammary-glands being *pectoral* in position, that is, placed on the breast. The placenta (which see) is deciduate and discoidal. The prehensile structure of the great toes is present even in *Quadrumanina* (as, for example, the Baboons), which are purely terrestrial in habits, and which walk on all fours. The hand thus throughout all the *Quadrumanina* is the prehensile organ, whilst the feet, however prehensile they may be, are also used for locomotion. The term *quadrumanina* is therefore to be strictly used in accordance with the idea of what constitutes the definition of the word 'foot.' Thus if Owen's definition of a 'foot,' that it is 'an extremity in which the hallux forms the fulcrum in standing or walking,' is accepted, then man alone can be said to possess a pair of feet, since the feet of apes do not fall within this definition. Anatomically, the feet of apes agree more closely with man's feet than with his hands; and the hands of apes similarly resemble man's hands more nearly than his feet. So that the name '*Quadrumanina*,' four-handed, viewed with reference to the structure and function of the limbs, is erroneous, since both man and apes possess but two hands and two feet. It might, therefore, be more correct to regard the *Quadrumanina* as Mammals provided with four well-developed limbs, the digits of which possess nails. These limbs may serve for climbing or for walking, and possess the hallux and generally the pollex opposable to the other digits. Teeth of three kinds, incisors, canines, and molars are developed, and are adapted for an herbivorous or insectivorous dietary. The body is covered with hair. The incisor teeth are generally present to the number of four, and the true molars to the number of six in each jaw.

As mentioned in the articles *LEMURS*, *MAMMALIA*, *MAN*, *MONKEYS*, &c. (which see), the *Quadrumanina* may be arranged through the form of the nostrils and through their geographical distribution into three very distinct groups, according to Owen's system of classification. The *Strepsirrhina* possess curved nostrils, and the second digit of the hind-limb has a claw. These forms are represented by the Lemurs, and by the Aye-aye, and are chiefly found in Madagascar, in Western Africa, and the Eastern Archipelago. The families *Lemuridæ*, *Tarsidæ*, and *Cheiromyidæ* represent this group. The *Platyrrhina* or broad-nosed monkeys do not possess opposable thumbs, and generally have prehensile tails. These forms, represented by the family *Cebidæ*, are confined to America. The *Catarrhina*, or Old World Monkeys, have oblique nostrils. The thumb is present, save in one instance—*Colobus*, and is always opposable. The

tail is not prehensile, and may be absent. The Anthropoid Apes and other members of the family *Simiadæ* represent this last group. See also article *MAN*, &c.

QUADRUPED, a name popularly applied to those higher vertebrate animals which possess four developed limbs. This name, in fact, is popularly, but not scientifically synonymous with the term *Mammalia* (which see), the highest class of Vertebrata, provided with a hairy body-covering; warm blood; non-nucleated red blood corpuscles; and two occipital condyles. As, however, certain Mammals do not possess four limbs, but (as seen in the Whales, Dugongs, &c.) have only the fore-limbs developed, the name 'quadruped' is inapplicable to the class as a whole; and Man himself, although possessing four limbs, would not, even in a popular sense, be termed 'quadrupedal,' but 'bipedal.' The name, whilst therefore used in a popular manner to indicate familiar members of the class *Mammalia*, has no value or significance in a scientific or technical aspect. Certain lower Vertebrata, as, for example, Lizards, Crocodiles, Frogs, &c., might, so far as the strict etymology of the term is concerned, be also termed 'quadrupedal' animals.

QUADRUPLÉ AND QUINTUPLÉ ALLIANCE. The natural but undue influence which European states have mutually exercised upon each other has at times produced alliances more complicated than any which history elsewhere records, and which could be produced only by a combination of various interests. Alliances of this nature indicate the existence of powerful interests and counter-interests, to trace which to their origin is one of the chief purposes of history. The first quadruple alliance, so called from the number of the contracting parties, was the alliance which was concluded October 28, 1666, between the States-General (Holland), Denmark, the Duke of Brunswick-Luneburg, and the Elector of Brandenburg. The second was concluded at London, August 2, 1718, between Great Britain, France, and Austria, and was called quadruple because acceded to by Holland, February 16, 1719. The object of this league was to force Spain to consent to the Peace of Utrecht. It continued to be so called even after the Duke of Savoy and Spain had joined the alliance. The quadruple alliance of Austria, Russia, Great Britain, and Prussia, at Chaumont, March 1, 1814, originated from their coalition, which had effected the dissolution of the French Empire. After effecting its object it became the basis of the European political system which prevailed with little effectual opposition until 1830, having been confirmed by the Congress of Vienna, the Holy Alliance, and the Congress of Aix-la-Chapelle, in October and November, 1818, when the alliance became, in a certain respect, quintuple, as France joined the union professedly for the maintenance of peace in Europe. England joined the three other powers for the overthrow of Napoleon; but when the alliance became obviously directed against the national independence which had been originally its professed object, and religious sophistry was blended

with political to deceive the people, and the right of armed interference was boldly pronounced, and in several instances carried into effect, England naturally separated more and more from the other powers in consequence of its constitutional system, until at length Canning proclaimed the principal of non-intervention.

QUÆSTOR, the title given to two classes of magistrates of ancient Rome, the *questores parricidii* and the *questores classici*. The former had their origin in the time of the kings, and at first were appointed only at critical times, but after the establishment of the republic they were elected annually by the curies, on presentation of the consuls. They disappear from history in 366 B.C., as their functions were transferred to the *Triumviri capitales*. They were two in number, and it was their duty to conduct the prosecutions of persons accused of murder or any other capital offence, and to carry the sentence into execution.—The *questores classici*, usually called *questors* simply, were intrusted with the charge of the public treasury. The office seems to have been first instituted by Valerius Publicola, and they derived the epithet of *classici* doubtless from their being elected by the centuries. The office could at first be held only by patricians until 421 B.C., when the number, which had formerly been two, was doubled, and plebeians became eligible. Their duties consisted in making the necessary payments from the public treasury and receiving the public revenue, keeping a correct account of both in their *tabulæ publicæ*; they registered and exacted all fines, provided proper accommodation for foreign ambassadors and for such personages as were connected with the republic by ties of public hospitality; and took charge of the funerals and monuments of illustrious men who were interred at the public expense. The number was further increased to eight after the outbreak of the first Punic war, and a *questor* accompanied each consul at the head of an army. At first they had only to superintend the sale of the booty, but we find that they subsequently had the charge of the funds of the army, becoming in fact its paymasters. The two *questors* who resided at Rome were distinguished by the epithet *urbani*. As province after province was added to the Roman territory the number of *questors* was again increased, till under Sulla it reached twenty, and in the time of Julius Cæsar forty. Any person holding the office of *questor* had a right to a seat in the senate, unless excluded by the next censors.

QUAGGA (*Equus Quagga*), a species of the horse genus, nearly allied to the more familiar zebra, formerly found on the plains of Southern Africa, but now quite extinct. The quagga was striped like the zebra, but did not possess bands on the limbs. The colour was a dark or blackish brown on the head, neck, and shoulders, the back and hind quarters being of a lighter brown, whilst the croup was of a russet gray. The under parts of the body were white, the upper parts of the legs and tail being marked by whitish bars. The quagga was of smaller size than the zebra, and in general conformation bore a closer resemblance to the horse than the latter form. The ears were short, the head being relatively small. The tail was tufted. These animals were of gregarious habits; the herds which inhabited the Kaffrarian plains numbering each several hundreds of individuals. These herds of quaggas were said to mingle indiscriminately with the zebra herds. The quagga was active, nimble, and elegant in its movements. Its food appeared to consist of grasses and Mimosa shrubs. It was tamed without much difficulty, but domestication apparently altered its disposition and rendered it dull and less active in

habits. The Dutch colonists were said to be in the habit of keeping quaggas along with their cattle; and the quaggas defended the cattle from the attack of hyænas and other Carnivora, by trampling on the invaders and otherwise injuring them. The name 'quagga' was derived from the cry of the animal, which may most nearly be expressed by the word *Coua-ag*. The Bushmen and Kaffirs esteemed the flesh of the quagga as good palatable food, and these animals were on the same account unremittingly pursued by the lion. The quagga bred with the common horse; and a mixed race of this kind, possessing great beauty of form, and retaining in a great degree the characteristic markings of the quagga, is said to have existed in England at one time. The quagga has received a variety of names from authors: thus Pennant terms it the *quacha*, and Masson the *opeayha*. It should be remarked that Edwards mistook it for the female zebra. The Dauw, Peechi, or Burchell's Zebra (*E. Burchelli*), appears to stand intermediately between the quagga and zebra, and is now often called quagga. See also ZEBRA.

QUAIL (*Coturnix*) a genus of Rasorial birds, included in the family of the Perdixes or Partridges (which see). The quails resemble the latter birds in general form, but want the red eyebrow or space above and behind the eyes seen in the Partridges; whilst the bill is naked at its base, of slender shape, convex superiorly, and curved towards its tip. The tarsi are destitute of spurs. The tail is short. The wings are rounded, the first quill-feather being of equal length with the rest. The true quails are inhabitants of the Eastern Hemisphere and Australia exclusively—the American Quail, to be presently mentioned, belonging to a different genus from the common members of the group. The true quail enjoys a very wide geographical distribution. It thus occurs in North Africa, India, and China. It is found in every European country, and also in the south of Siberia, either as an annual visitor, or permanent resident. In Italy, Spain, and Portugal these birds thus appear to be permanent residents, large numbers in addition arriving in these countries in spring from North Africa and the south. Large quantities of quails are killed during this annual northward flight on the Mediterranean shores. In Britain the quails are not so abundantly represented as in France and on other portions of the Continent. The London market is supplied chiefly from France. In Britain these birds arrive early in May, and depart southwards in October. The males arrive first, and make known their presence by a thrice-repeated whistle. They may sometimes be lured and captured by the skilful imitation of the note of the female.

The common or European Quail (*Coturnix doctylisomans*) attains an average length of about 8 inches. The feathers of the head are black, edged with a rusty brown. The hinder part of the neck and crown of the head are divided by a long pale-yellow line; the breast is of yellowish-red, spotted with black; the scapulars and feathers of the back are marked with a pale yellow line in their middle, and with ferruginous and blackish bars on their sides. The males largely exceed the females in number; and the song-notes of the sexes are quite distinct. These birds are alleged to be polygamous in habits, but this statement must be regarded as doubtful. The males assist the females in the care and upbringing of the young. The flesh is more juicy and delicate than that of the partridge. The nest is little else than a hole scratched in the ground. From six to twelve, or even fourteen eggs, of an oily green colour, are deposited; the larger number prevailing on the Continent, whilst in Britain six or eight are the usual numbers contained in a 'bevy' of quails. These

birds have also been noted on account of their pugnacious proclivities, and 'quail-fights' were indulged in as amusements by the ancient Greeks and Romans, just as combats of this nature afford amusement to the modern Chinese, and in some parts of modern Italy. The fighting quails are generally armed with artificial 'spurs', after the fashion of fighting cocks. The food consists of grains and seeds, insects and worms; but for the table, quails are principally fed on hemp-seed. See fig. at ORNITHOLOGY (Pl. IV.).

Discussions have arisen regarding the zoological position of the quail which served as food for the Israelites in the desert; Hasselquist maintaining its identity with a species of Grouse, which he called *Tetrao israelitarum*, whilst Colonel Sykes and others regard the scriptural quail as simply the modern and common quail just described.

Other species of true quails, distinguished by differences in the tongue and cræca, are described under the names of *Coturnix textilis*, *C. erythrorhyncha*, *C. Pentah*, and *C. Argondah*. The last-mentioned species is the Rock Quail of Dukkun or Deccan, and which is distinguished by the presence of numerous narrow transverse black bars on the breast. The young of this species want these bars, and also vary greatly in the markings of the back-plumage. The flesh of the Rock Quail is white; and by the natives of its districts this species is used for quail-fights.

The Virginian, Maryland, or American Quail or Partridge (*Ortyx Virginianus*), as it is variously termed, is included in the sub-family Odontophorinæ, together with another species known as the Californian Quail (*O. or Lophortyx Californicus*), and distinguished by the possession of a crest of curved feathers born on the top of the head. The Virginian Quail possesses a short, highly arched bill, and large naked nostrils. The tarsus is smooth, the lateral toes of unequal size, and the tail is of moderate length. No spurs or crest exists. This bird is about 9 inches long and 14 in extent, usually weighing from 7 to 8 oz. The bill is black; a line over the eye, down the neck and whole chin being pure white, bordered by a band of black, which descends and forms a crescent on the throat; the eye is dark hazel; crown, neck, and upper part of the breast, red brown; sides of the neck spotted with white and black on a reddish brown ground; back, scapulars, and lesser coverts, red brown, mixed with ash, and minutely marked with black; wings plain and dusky; lower part of the breast and belly whitish, marked with black arrow heads; tail ash, spotted with reddish brown. The American Quail is common throughout North America, and extends in its distribution as far south as Honduras. The American Quail appears to differ from its migratory neighbours of the old world in being locally distributed; a fact well known to American sportsmen, who are in the habit of turning out pairs of these birds, when an unusually severe winter has destroyed the coveys in the neighbourhood. The female constructs her nest in May, and lays about fifteen or twenty eggs, which are perfectly white. Wilson is of opinion that the common idea, that quails occasionally lay in each other's nests, is correct. The food of the quail is composed of grain, seeds, insects, &c., buckwheat and Indian-corn being the favourite articles. The flesh is very white and tender, and is unequalled in delicacy by any other member of its order in America.

The Andalusian Quail (*Turnix tachydromus*) belongs to the sub-family Turnicinæ, and represents the only member of that group found in Europe. It is a native of both European and African shores of the Mediterranean, and appears to be of migratory habits. The bill is nearly straight, and of moderate length, the tip of the upper mandible overhanging

the lower one. The nostrils are situated in a groove which runs beyond the middle of the bill. The tarsus are stout; the toes elongated and free at their bases; wings short; and the tail is hidden by the dorsal feathers. The food consists of seeds and insects; and these birds are said to be polygamous in habits.

QUAKERS, or FRIENDS, a society of Christians which took its rise in England about the middle of the seventeenth century. George Fox, a native of Drayton, in Leicestershire, was the first minister whose preaching was instrumental in convincing the people of those religious views which distinguish the society. He was born in the year 1624, and commenced his ministerial labours in 1647, being then in the twenty-third year of his age. The times in which he appeared were times of great social and religious agitation in England, the times of Cromwell and the Commonwealth. The principles of religious toleration were neither understood nor practised, and Fox immediately fell under persecution. His life was for a long time little better than a pilgrimage from prison to prison. But persecution, as usual, made him the object of public attention, and enlisted the sympathies of many in his cause. His missionary life extended over forty years, in the course of which he travelled repeatedly over all England and Scotland, besides visiting the Continent, and performing a missionary tour among the infant colonies of America. After making multitudes of converts he organized them into a church, which became one of the recognized sects of Christianity. Among the eminent ministers of the society we may notice George Fox, William Penn, Robert Barclay, George Whitehead, Stephen Crisp, Isaac Pennington, John Crook, Thomas Story, &c. The infant society was soon subjected to the rigours of a severe persecution, sometimes without the pretext of law, and at other times under cover of legal enactments, made either in Roman Catholic times or since the Reformation against nonconformists. The early Quakers were marked as a peculiar people by their testimonies against oaths, a paid ministry, tithes, and other ecclesiastical demands; their use of the singular pronouns when addressing only one person; their refusal to take off the hat as a compliment to men; and the faithful maintenance of their religious meetings. George Fox was one of the first who was imprisoned. In 1650 he was arraigned before two justices in Derbyshire, and on his exhorting those about him to tremble at the Word of God, one of the justices deridingly gave him and his friends the appellation of *Quakers*, which has since been generally applied to them by the world, though they themselves, as well as their successors, have adopted the name of *Friends*. The violence of persecution only tended to confirm the faith and strengthen the bond of union among the members of the rising society. Its ministers boldly preached their doctrines both publicly and privately, and were not deterred from their gospel labours by the severest punishments. The members, with one accord, united in strengthening each other's faith, encouraging all to continue steadfast to the religion they had espoused, and to endure with patience and even cheerfulness the loss of their estates, imprisonment, fines, whipping, banishment, and even death itself, rather than renounce their principles or violate their testimonies. The spirit of intolerance which caused the society so much suffering in England spread its baneful influence to America, and produced its natural results there also; but in neither country could it shake the constancy of the sufferers nor induce them to relinquish their conformity to what they regarded as duty. Their patient submission to the wrongs inflicted on them, the integrity and blame-

lessness of their lives, their probity, and the peaceable principles which they held, not only wrought conviction on the minds of many, and thus added to their numbers, but also had a favourable influence on those in authority, who saw that severity served rather to increase and establish the society than to arrest its progress. From these causes, as well as the diffusion of more liberal and enlightened views on the subject of religious liberty, acts were successively passed by the British Parliament, relieving Friends from the oppression under which they suffered, and tolerating their mode of worship, marriage, &c., and allowing them in a court of justice to make an affirmation in place of taking an oath in the usual way. The same liberal policy has been continued by the American government, so that at present they suffer no other molestation in that country than the occasional disquiet of their property to satisfy demands made in lieu of military services, which they cannot conscientiously pay. In Great Britain they stand on the same footing as other people in respect of their liability to pay church-rates, and the mode of disputing the validity of the rate. The first Friends that went to America were two female ministers, who landed at Boston about the year 1656. Others occasionally visited that country at subsequent periods; and a number of persons having embraced the principles of the society, George Fox went over in 1672, and settled meetings of discipline for the care of the poor and the preservation of good order in the church. At this period there were meetings of Friends in most of the colonies along the sea-coast from Massachusetts as far south as the Carolinas. In 1682 William Penn arrived in the river Delaware with a large number of his brethren, who founded the city of Philadelphia, and settled themselves there or in the adjacent counties; and in each successive year their numbers were increased by new emigrants from the mother country, until they formed a large and respectable colony. Most of the ancient families in Philadelphia and its vicinity trace their origin to these settlers, and many of the noblest institutions of that city owe their rise to the liberality and benevolence of the Society of Friends. In the course of time it was found that the society had to a great extent lost its powerful influence as a proselytizing agent. The quietness of its worship, and even absolute silence of some of its meetings, deprived of the enlivening influence of sacred music, which has so often rendered invaluable service to the Christian church in all ages, made the Quaker assemblies unattractive to the masses and even to the young of their own community. The want of a distinct clerical order to think, write, and speak for them, and consequently the want of an extensive denominational literature, has checked the propagation of their church. Another cause has also operated in the same direction. Fox made his converts chiefly among the rural population; they were spread almost all over England; their property was in land and real estate, or such personal effects as were not likely to escape the notice of the tax-gatherers, and were easily subjected to assessment and distraint. The Quaker was bound on principle to resist the payment of tithes, and did so; vexation and loss were his constant portion. In the lapse of two centuries this produced a marked effect on the sect. It drove them into the cities, compelling them to invest their capital in different ways, and so wrought a change in their habits and mode of life. Numbers of them, owing to their frugality and prudence, acquired enormous wealth, with which came influence and social position. They became the associates and rivals of nobles and statesmen; they found themselves sitting side by side with the dignitaries of the church, who

had seats in the House of Lords, and participated in national legislation. This was certainly a great change since the days when a hireling priesthood was an abomination, and the churches of the Establishment were derided as steeple-houses. Desertions from their ranks became numerous, and what was wholly unanticipated, the deserters went over to the once obnoxious Episcopal Church. Great wealth and recognized position operated likewise against the discipline of the body. Originally this discipline had been exceedingly stringent; their dwellings were subjected to a domiciliary visitation, and offenders were made to feel at once and emphatically that they had violated rule and forfeited the good opinion of their brethren. Those living in splendid mansions must be endured with an eminent gift of Christian meekness to be able to receive such a visit with becoming humility and submission, and those who administer such an act of discipline must have an assurance quite as extraordinary in order to do it with emphasis and effect. The consequence of this change of position has been a decline of the ancient discipline, and a relaxation of the watchfulness which the Friends once thought themselves bound to maintain over each other. About the year 1827 this peaceful sect which had existed so long without creed or confession began to be distracted by dogmatic debate. About that time Elias Hicks, a native of the state of New York, a man of uncommon depth and strength of mind, as well as force of character, great natural eloquence, and unswerving rectitude of life, created a schism in the society by promulgating opinions denying the miraculous conception, divinity, and atonement of Christ, and also the authenticity and divine authority of the Scriptures. About half the sect in America followed Hicks, and have since been known as the Hicksite Friends; their opinions are repudiated by the rest of the sect, who may be looked upon as the Orthodox Friends. The schism created immense excitement in the body in Great Britain as well as in America, and a movement was begun in favour of a higher education, of a creed closely allied to that of the evangelical party, and of a relaxation in the formality of the society. This movement, which was headed by Joseph John Gurney, of Norwich, was strenuously opposed by a body of Quakers in America, and the result was a division among the Orthodox Friends themselves, and the origin of a new sect, known as Wilburites, from the name of their founder John Wilbur. This sect is noted for the strictness with which they adhere to the traditions and peculiarities of the society. Some slight indications of theological differences have also shown themselves among the English Quakers. The society, as a whole, is never supposed to have exceeded 200,000 members; the number at present is estimated at 120,000, about three-fourths of whom belong to the United States.

In attempting to give a view of their testimonies and doctrines, the limits necessarily prescribed in an encyclopædia forbid anything more than a brief sketch. The society, or rather what we have called the orthodox section of it, believes that, under the gospel dispensation, all wars and fightings are strictly forbidden; the positive injunction of Jesus Christ, 'Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you and persecute you,' entirely precluding the indulgence of those malignant passions from which only such contests can arise. They also apprehend that the express command of our Lord and his apostle James, 'Swear not at all,' prohibits the Christian from the use of judicial as well as other oaths, and that in all things his word should be yea and nay, 'for whatsoever is more than this

cometh of evil.' As Jesus Christ declared to his disciples, that without him they could do nothing, and as he alone is the Head and Governor of his church, the society believes that a special call and qualification from him, by the influences of his Spirit on the soul are necessary to constitute a true minister of the gospel; and that as he commanded his disciples 'Freely ye have received, freely give,' so the faithful minister of Christ cannot make merchandise of the gift received, nor decline the exercise of it because he may not be compensated by a pecuniary reward. Owing to their theory that the real ministry of the community is merely the organ by which 'the Spirit speaks to the churches,' women, of course, may participate in the office of public teaching, edifying speech being considered a sufficient authentication of a religious teacher. It being generally admitted that the baptism of water and a participation in the outward supper are but the signs of that essential baptism of the Holy Ghost which our Lord Jesus Christ instituted, and of the communion of saints to which he alludes when he declared to the apostle John in the Revelation, 'Behold, I stand at the door and knock; if any man hear my voice and open the door, I will come in and sup with him, and he with me;' and as this spiritual baptism and communion are not dependent on the outward rites—the society does not consider these as necessary, but presses on its members a submission to the effectual operation of the Holy Spirit, by which the obedient soul is brought to the living experience of the substance of which these ceremonies are but the external symbols. As early as 1727 they freely censured the traffic in slaves as a practice neither commendable nor allowed, and the efforts of the society had a great influence in bringing about their emancipation. As simplicity and gravity in dress and demeanour are consonant with the Christian character, the society recommends its members to observe plainness in their apparel and the furniture of their houses, an adherence to the use of the singular pronouns 'thee and thou,' when addressing only one person, and the disuse of the customary salutations and tokens of obeisance. Its conduct in these respects arises from the apprehensions that the contrary practices originated in the pride of the human heart, and have a tendency to foster that haughtiness and self-conceit which it is so much the business of the Christian to mortify and subdue. The Friends object to balls, gaming-places, horse-races, and theatres; to indulging in music, especially what is generally called sacred music, and denounce oratorios and performances of that nature as essentially a profanation; they object also to the reading of plays, romances, novels, and other pernicious books, and to the vain custom of wearing mourning and all extravagant expenses connected with the burial of the dead. They do not use the ordinary names of the days and the months, as they are derived from pagan sources, but designate them by their numbers. The doctrines of the society may be stated in a few words; in doing which it will be proper to observe that its members prefer the use of such terms as are to be found in the Holy Scriptures. They believe in God, the Father; in Jesus Christ, his beloved and only begotten Son; and in the Holy Ghost, Comforter or Spirit of Truth, one true and living God, blessed for ever. That these are the holy Three that bare record in heaven; to wit, the Father, the Word, and the Holy Ghost, and that these three are one. That in the fulness of time our Lord and Saviour Jesus Christ took flesh, was conceived by the Holy Ghost, and born of the Virgin Mary at Bethlehem in Judea; that he was crucified under Pontius Pilate, voluntarily surrendering himself to the ignominious death

of the cross, and suffered for our sins, the just for the unjust, that he might bring us to God; thereby becoming the one, great, universal offering and atonement for all mankind. Hence 'he is the propitiation for our sins, and not for ours only, but for the sins of the whole world;' and as each individual submits to the power of the Holy Spirit, renewing and changing the heart, his past transgressions are freely forgiven and blotted out for Christ's sake, and he comes fully to partake of the benefits of that redemption which was purchased for us by the coming, and sufferings, and death of the adorable Son of God. In expressing themselves concerning this glorious display of the love of God to fallen man, they include a full belief in the deity and manhood of Jesus Christ; in his miraculous birth, holy life, mighty miracles, death, resurrection, and ascension into glory in the heavens, where he is at the right hand of God, as our Redeemer, Mediator, and Advocate with the Father, and whence he shall come to judge the world in righteousness at the great and final day of judgment. As the whole human race is naturally fallen, degenerate, and spiritually dead, of themselves utterly incapable of doing anything that will tend to their salvation, so the society believes that all have need, and are the objects of that redemption which is freely offered for their acceptance through Jesus Christ our Lord. That 'the grace of God, which bringeth salvation, hath appeared unto *all men*;' teaching us, that, denying ungodliness and worldly lusts, we should live soberly, righteously, and godly in this present world; and that obedience to its dictates is essentially necessary to enable us to persevere in the work of pure and undefiled religion, and finally to receive the end of our faith, even the salvation of our souls. That there shall be a resurrection, both of the just and the unjust, according to the declaration of our blessed Lord, 'The hour is coming, in the which all that are in the graves shall hear his voice, and shall come forth; they that have done good unto the resurrection of life, and they that have done evil unto the resurrection of damnation,'—and that, according to the testimony of the apostle Paul, 'It is sown a natural body, and raised a spiritual body.' Although Friends do not call the Holy Scriptures the Word of God, but apply this epithet exclusively to the Lord Jesus Christ, yet they believe that these sacred writings are the *words* of God, written by holy men, as they were moved by the Holy Ghost; that they are profitable for doctrine, for reproof, for correction, for instruction in righteousness, that the man of God may be perfect, thoroughly furnished unto all good works; and that they are able to make wise unto salvation through faith which is in Christ Jesus. They also hold them to be the most authentic and perfect declaration of Christian faith, and the only fit outward judge and standard in all religious controversies; and that whatever, either in doctrine or practice, any profess or do, though under pretence of the guidance of the Holy Spirit, if it be contrary to or inconsistent with the testimony of the Holy Scriptures, it is to be esteemed a delusion and error.

The society is governed by its own code of discipline, which is enacted and supported by meetings of four degrees for discipline—namely, preparative, monthly, quarterly, and yearly meetings. The preparative digest and prepare the business for the monthly meetings, in which the executive power is principally lodged, subject, however, to the revision and control of the quarterly meetings. These are usually composed of several monthly meetings, which are accountable to the quarterly, and over which it exercises its jurisdiction and care. The yearly meeting comprises a number of quarterly meetings, which are

subordinate and accountable to it, and subject to its supervision and direction. Its authority is paramount, and it possesses the sole power to make or amend the discipline. For further information see Sewell's and Gough's Histories of the Quakers, G. Fox's Journal, Barclay's Apology, Evan's Exposition, Gurney's Peculiarities, &c.

QUAKING GRASS (*Briza*), a genus of grasses belonging to the tribe Festucineæ. It is known by its broad, three-ribbed glumes and its great boat-shaped, cordate, blunt, broad, awnless, lower pales, both of which have a membranous border. The species are few, and are mostly confined to Europe. *Briza maxima*, a native of Southern Europe, has been long and generally cultivated as a garden annual on account of its large and handsome drooping spikelets. *Briza media* is the only species common in this country. It is a perennial plant, with tufted, fibrous roots; the stem never exceeds 18 inches in length, and is usually shorter; it bears at the base a number of dark-green leaves. The spikelets are ovate, arranged in a loose panicle, each containing about seven florets, the lowest of which are sometimes larger than the glumes. These spikelets have a purplish colour, and are suspended by very slender, wiry stalks, on which they swing freely, trembling at every breeze. It flowers in the end of June, and is ripe by the middle of July. It is of some small agricultural value. Horses, cows, and sheep will eat it, and it is well suited to poor soils, whether sandy or heavy; any attempt to enrich the soil with manure is fatal to this grass. It is found in Britain at altitudes of 1500 feet above sea-level. Another species, *Briza minor*, much smaller in all its parts, with many triangular spikelets, also occurs in this country, but it is very rare, and of no agricultural value.

QUANTIFICATION OF THE PREDICATE, in logic, the use of some word or words to indicate whether the predicate of a proposition is distributed or not, that is, whether or not all the objects of which the predicate may be asserted are also objects of which the subject may (in affirmative propositions) be asserted or (in negative propositions) denied. Thus, when we say, Some men are logicians, we do not know from the form of the proposition whether we may not apply the predicate logicians to any who are not men, but if we quantify the predicate and say, Some men are all logicians, we at once show that this application cannot be made. Ploucquet and Lambert in the 18th century suggested the quantification of the predicate, but Sir William Hamilton was the first to give notoriety to the doctrine by the importance that he attached to it. He considered it as involving a complete revolution in formal logic. The theory of the necessity for the quantification of the predicate in logical analysis is based on the view that every proposition is an equation between the subject and the predicate, although in negative propositions this equation consists only in the terms being equally exclusive of one another. On this view he contended that the number of propositional forms recognized by logicians should be increased from four to eight, which he designated and symbolized in the following manner:—

Affirmatives.

- | | |
|-------------------------|------------------------------|
| 1. Toto-total = AFA. | Example—All X's are all Y's. |
| 2. Toto-partial = AFI. | " All X's are some Y's. |
| 3. Parti-total = IFA. | " Some X's are all Y's. |
| 4. Parti-partial = IFI. | " Some X's are some Y's. |

Negatives.

- | | |
|-------------------------|-----------------------------|
| 5. Toto-total = ANA. | Example—Any X is not any Y. |
| 6. Toto-partial = ANI. | " Any X is not some Y. |
| 7. Parti-total = INA. | " Some X is not any Y. |
| 8. Parti-partial = INI. | " Some X is not some Y. |

It will be seen that in the symbols used by Sir William Hamilton F indicates affirmation, N negation, A distri-

bution, I indistribution, and the position of A and I on the right or left of the symbol of affirmation or negation shows whether it is the subject or predicate that is distributed or undistributed. Among the numerous changes in the theory of formal logic that Sir William Hamilton points out as inevitably following the adoption of a quantified predicate the most important are the reduction of the conversion of propositions from three species to one (see LOGIC—Conversion), the reduction of all the general laws of categorical syllogisms to a single canon, and the abrogation of all the special laws of syllogism—a manifestation that figure is an unessential variation in syllogistic form, and that the practice of reducing the syllogisms from the other figures to the first is consequently absurd, and a large increase of the number of legitimate moods. As to the first of these changes ensuing on the adoption of a quantified predicate it needs but the slightest consideration to see how it comes about, for if all propositions are reduced to equations between subject and predicate it is obviously a matter of indifference which term of the equation be placed first, whether we say, All men are some animals, or Some animals are all men. The single canon that Sir William Hamilton substitutes for all the general and special laws of the syllogism is the following:—What worse relation of subject and predicate subsists between either of two terms and a common third term, with which one at least is positively related; that relation subsists between the two terms themselves. With regard to this canon it requires to be explained that a partial relation of one term to another and a negative relation of one term to another are considered as respectively worse than a total and an affirmative relation. Thus, in a syllogism with premises of this nature, Some useful animals are all horses, Any horse is not any carnivorous animal, Sir William Hamilton would say that the subject of the first premise bears a partial and therefore a worse relation to the predicate which is the common third term with which the subject of the first and predicate of the second premise are compared than the predicate of the second premise does, and that in the second premise the predicate bears a negative and therefore worse relation to the subject; whence it would follow that the subject of the conclusion (which is the subject of the first premise) must bear to the predicate a partial relation, and the two terms of the conclusion a negative relation to one another, the conclusion being in the form, Some useful animals are not any carnivorous animals. The inessential nature of differences of figure which Sir William Hamilton says is shown at once by quantifying the predicate is an obvious corollary from the fact that any proposition with a quantified predicate can be stated indifferently with either term first. Finally, the increase of the number of moods is manifestly a necessary consequence of the increase of propositional forms.

This doctrine of the quantification of the predicate was attacked immediately after it had been enunciated by Sir William Hamilton, as it has often been attacked since; and it has never been generally adopted in the exposition of formal logic. The principal ground on which it is attacked is that it is based on a complete misunderstanding of the true nature of a proposition. A proposition, it is said, is in no sense an equation between two terms, but is a form of words asserting or denying that the subject possesses the attributes expressed by the predicate. It does not indicate anything about the whole number of objects to which the predicate may be applied, but merely whether certain attributes do or do not belong to the subject. Accordingly when any form of words does indicate anything about the whole number of objects to which the predicate may be applied it is in reality a compound of two propositions. Thus, the proposition, All equilateral

triangles are all equiangular triangles, is compounded of the two, All equilateral triangles are equiangular, and All equiangular triangles are equilateral; and the proposition, Some men are all logicians, of the two, Some men are logicians, and All logicians are men. Then with regard to negative propositions, in which the predicate is partial, the attempt to establish them as an independent class of propositions is more completely illusory than it is to make affirmative propositions with a total predicate a separate class. A formula such as, Any man is not some animal, is not a predication at all, inasmuch as it does not say whether the attributes expressed by the predicate belong or do not belong to the subject, and all the meaning that the formula has is due to the fact that it implicitly denies something of the predicate, that it is indeed a contorted and unobvious way of saying that Some animals are not men. With a parti-partial negative proposition such as, Some Europeans are not some men, the case is even worse. By no manipulation is it possible to derive any information whatever from this formula. The objection, then, to Sir William Hamilton's additions to affirmative propositions is that they express too much, and to his additions to negative propositions that they express too little. The latter objection is decidedly the more serious, and hence the class of propositions to which it applies are rejected even by some of those who admit the affirmative propositions of Sir William Hamilton into their system. For the toto-total affirmative proposition the plea is made that every definition is an example of it. If we define man as a rational animal we mean not only that all men are rational animals but that men are all the rational animals that exist. But it is questionable whether this is a correct account of a definition. When we define a word all that we assert is that the word and its definition mean the same thing, from which it necessarily follows that they must be applicable to the same objects. For the parti-total affirmative proposition again it is pleaded that it is the only adequate converse of the universal affirmative of ordinary logic. When we convert All logicians are men into Some men are logicians we really mean, it is asserted, that Some men are all logicians. But this also is questionable. It may be contended that when we obtain the proposition Some men are logicians by conversion from All logicians are men we mean by that only what we say, and although it is the case that this proposition, if reconverted, would only give Some logicians are men, that does not matter practically, for since it is already admitted that All logicians are men (otherwise Some men are logicians could not have been obtained by conversion from that proposition) there can be no occasion for reconvertng in that form. A better case might be made out for these additional affirmative propositions of Sir William Hamilton if it could be shown that any practical advantage in logic could be derived from their adoption; but there is no proposition that can be made that cannot be dealt with under the present logical forms, and the simplification of the theory of logic that is said to result from their adoption is not apparent from the example we have given above of the application of the new theory to a particular case—not apparent, that is to say, if to simplify is to render more easily intelligible.

It would take up too much space to go into all the details of the working out of the Hamiltonian theory of the quantification of the predicate; we therefore refer the reader to the Essay on the New Analytic of Logical Forms, by T. S. Baynes; Appendix II., annexed to Sir William Hamilton's Discussions, and the Appendices to his Lectures on Logic; Spalding's article on Logic in the Encyclopædia Britannica (8th ed.); and Mill's Examination of Hamilton's Philosophy.

QUARANTINE, the period during which a ship, coming from a port suspected of contagion, or having a contagious sickness on board, is forbidden intercourse with the place where she arrives. The term is derived from the Italian *quarantina*, a space of forty days, because originally that was the fixed period for all ships under such circumstances. But the time of a ship's detention is now very various, according to the exigencies of the case. By the 6 Geo. IV. c. lxxviii., masters of vessels liable to quarantine are bound to hoist the yellow flag on meeting other vessels at sea, or being within 2 leagues of the United Kingdom; they must answer interrogatories made to ascertain the state of their ships; they must not conceal the fact of their having touched at an infected place; they must not refuse to convey their vessel to the place appointed for quarantine; they must not quit their vessels during the period of quarantine, nor allow any other person to quit them. Noncompliance with the terms of the act subjects the offender to heavy penalties. Persons arriving in any infected vessel, or going on board and quitting it before discharged from quarantine, are liable to six months' imprisonment and a penalty of £300.

QUARLES, FRANCIS, an English poet, born in 1592, near Romford in Essex, was educated at Cambridge, and entered at Lincoln's Inn. He was for some time cup-bearer to Elizabeth, queen of Bohemia, the daughter of James I., but before 1629 went to Dublin, where he became private secretary to Archbishop Ussher. Not later than 1633 he returned to England, and in 1639 he was appointed chronologer to the city of London. At the commencement of the civil wars he wrote a work entitled the *Loyal Convert*, which gave offence to the Parliament; and when he afterwards joined the king at Oxford his property was sequestrated, and his books and MSS. plundered. He was so much affected by his losses, that grief is supposed to have hastened his death in 1644. Of the works of Quarles, in prose and verse, the most celebrated is his *Emblems*, a set of designs in prints, illustrated by verses. A great part of them are borrowed from the *Emblems* of Hermanus Hugo, but the verses are his own, and in the midst of much false taste and conceit contain frequent bursts of fancy and strokes of pathos. His *Enchiridion* is a collection of brief essays and aphorisms, in vigorous and occasionally eloquent language.

QUARRY, an open excavation made for obtaining stone, such as granite, marble, sandstone, limestone, and slates; so called, according to most authorities, from the fact that the stones are usually squared (old French, *quarré*) for building purposes, though others derive the name from the Erse *carraig*, a stone. At a very early period the sandstone rocks in the mountains of Silsileh, stretching along the banks of the Nile, were extensively quarried by the Egyptians, as material for the walls of their temples; the obelisks and statues which adorned those temples are formed of granite hewn from the quarries in the islands of Philæ and Elephantine, and particularly from the immense excavations in the mountain terraces near Syene. The Greeks obtained the materials of their finest temples and sculpture from the quarries of Mount Pentelicus, near Athens, and the islands of the Archipelago; in Greece and in Asia Minor an abundance of a greenish-white stone was dug from the earth for the ordinary purposes of architecture. Ancient Rome, as we learn from Vitruvius, was chiefly built of the calcareous stone obtained from the Travertine quarries; when the city was rebuilt after its destruction by fire in Nero's reign, the houses were constructed of the Alban and Gabian stone. For sculptured work the red stone from the quarries near the Lake of Bolsena was generally used.

The Carrara quarries, on the north-west slope of the Apennines, have long been famous for the fine white marble which they yield, and which is so extensively used for statuary. In the British Isles is found abundance of every kind of stone which can be used with advantage in architecture. To give a few examples of localities—granite is obtained from the quarries of Cornwall, Aberdeen, and Wicklow; sandstone from those in the vicinity of Edinburgh, Glasgow, and Newcastle; limestone from the Kingston quarries in the Isle of Portland, Swanwich, in the Isle of Purbeck, and those in the neighbourhood of Bath; slates from the quarries of Argyleshire and North Wales; and marble from those of Derby, Devon, Kilkenny, and Galway.

The first operation in quarrying is the removal of the superficial vegetable mould by the spade, and then of the beds immediately beneath, the latter consisting of clay, sand, &c., or of stone of an inferior quality, which is broken up by blasting or otherwise. The stones for important building purposes are usually found at a good distance below the surface. In the case of unstratified rocks, such as granite, whinstone, &c., stones are most frequently detached from the mass by blasting, a process by which much valuable stone is wasted, and a different method is employed whenever it is found possible. This is frequently the case with some stratified rocks, such as sandstone, from which blocks are separated by hand-tools alone. Small holes a few inches asunder are cut along a certain length of rock, into which steel wedges are inserted. These are driven in by heavy hammers until the stratum is cut through. The large blocks necessary for monumental purposes are obtained generally in this way. Before they leave the quarry they are usually reduced as nearly as possible to a rectangular form; the irregular parts are knocked off by a tool called a kevel, flat at one end and pointed at the other. Powerful cranes are employed for lifting or turning the heavier blocks. Where the water from the workings cannot be drawn off by syphons a steam-engine and set of pumps are absolutely necessary in a quarry of any extent.

Quarries belong to the owner of the lands in which they are situated, and no person can work a quarry or remove the materials unless he derives his right from the owner by lease or other legal title.

QUART, an English measure of capacity, being the fourth part of a gallon, or 2 pints, or 8 gills. The ordinary quart bottle, however, is made to contain only from 5 to 6 gills.

QUARTAN AGUE. See AGUE.

QUARTER, the name of two English measures, one of weight and the other of capacity. The first is the fourth part of a hundred-weight, or 28 lbs. The second contains 8 bushels of 4 pecks. It is uncertain whether it is the fourth part of some long-since-disused measure, or whether the word is connected with a division of land known by the same name.

QUARTER, in heraldry, one of the four (or more) squares into which an escutcheon is 'quartered' or divided. See QUARTERING, HERALDRY.

QUARTER, that part of a ship's side which lies towards the stern, or which is comprehended between the aftmost end of the main chains and the sides of the stern, where it is terminated by the quarter-pieces; or that portion of the side of a vessel which is between waist and stern.

QUARTER-DAYS, the days which begin the four quarters of the year: namely, the 25th of March, or Lady-day; the 24th of June, or Midsummer-day; the 29th of September, or Michaelmas-day; and the 25th of December, or Christmas-day. In England and Ireland it is usually contracted between landlord and tenant that rent should be paid, and that houses

may be entered or left on these days. If no arrangement of this kind has been come to, rent can only be claimed once a year. In Scotland there are two legal term days, Whitsunday (15th May) and Martinmas (11th November), on which, if no contrary agreement is made, rents are legally due. For houses taken by the year, May 28 is the removal day. There are also two conventional terms, Candlemas (2nd February) and Lammas (1st August), on which rents are frequently paid.

QUARTER-DECK, the upper deck of a vessel, extending from the main-mast to the poop, or, when there is no poop, from the main-mast to the stern; or that portion of the deck corresponding with the quarters. In the navy the quarter-deck is used as a parade by the officers, and when the captain wishes to address the crew, or confer a mark of distinction, the men are summoned aft to the quarter-deck.

QUARTERING, in heraldry, is dividing a coat into four or more quarters or quarterings, by parting, coupling, &c., that is, by perpendicular and horizontal lines, &c. See HERALDRY.

QUARTER-MASTER, in the British army, an officer who attends to the quarters for the soldiers, their provisions, fuel, forage, &c. There is a quarter-master on the staff of each infantry battalion and cavalry regiment. The Royal Artillery, the Royal Engineers, the Army Service Corps, and the ordnance store department have each a number of quarter-masters, besides those connected with the militia and volunteers. The office is almost always given to an experienced sergeant, who, if he serves thirty years in all, including ten as quarter-master, may retire with the honorary rank of captain. His pay begins at 10s. 6d. a day in the cavalry, 9s. 6d. in the artillery, and 9s. in the infantry and marines.

QUARTER-MASTER, in the navy, is a petty officer, who, besides having charge of the stowage of ballast and provisions, coiling of ropes, &c., attends to the steering of the ship, and sees that she is kept in her proper course.

QUARTERMASTER-GENERAL, a staff-officer of high rank in the British army, who is the head of one of the military divisions of the War Office. His division is charged with all orders relating to the marching, embarking, disembarking, billeting, quartering, and cantoning of troops, encampments and camp equipage. These functions are carried out in the various commands by the Army Service Corps, under the direction of assistant and deputy-assistant adjutant-generals, who take their orders from the generals commanding the district. The quartermaster-general's division comprises five subdivisions, namely barracks, transport, supplies, remount, and army service corps.

QUARTERMASTER-SERGEANT is a non-commissioned officer who assists the quarter-master. In the artillery his daily pay is 4s. 2d., in the cavalry 3s. 10d., and in the infantry 3s. 6d.

QUARTER-SESSIONS, in England, a tribunal held by two or more justices of the peace (one of whom must be of the quorum), in every county and division of county once every quarter of a year. Under the 1 Will. IV. cap. lxx. these sessions in the several counties, ridings, and divisions are required to be held in the first week after the 28th of December, in the first week after the 31st of March, in the first week after the 24th of June, and in the first week after the 11th of October; called otherwise the Epiphany, Easter, Trinity, and Michaelmas sessions. But by a later statute the justices may direct the Easter sessions to be held any time between the 7th of March and the 22d of April, so as not to interfere with the spring assizes. The jurisdiction of these courts, originally confined to matters touching the

breach of the peace only, has been gradually extended to the smaller misdemeanours and felonies, but with many exceptions; there is also an extensive jurisdiction in matters relating to the settlement of the poor, highways, conviction of vagrants, bastardy, &c., in most of which cases an appeal lies to the King's Bench Division. The judges of quarter-sessions in the counties are all unpaid; they generally choose a chairman from among themselves to preside, an office of great honour and considerable responsibility. In boroughs quarter-sessions are now held by the recorders, who are barristers, who are appointed by the home secretary, and receive a small salary out of the borough fund. In Middlesex barristers are appointed for the trial of prisoners, and have the title of assistant judges. See also LOCAL GOVERNMENT.

In Scotland there are also courts of quarter-sessions held by the justices of peace four times a year at the county towns. The times of meeting are the first Tuesdays of March, May, and August, and the last Tuesday of October. At these meetings the justices have the power of reviewing the sentences pronounced at the special and petty sessions, when the sentence is of a nature subject to review. Such cases as fall to be tried by the English courts of quarter-sessions, are in Scotland disposed of in the sheriff courts of the county.

QUARTER-STAFF, an old English weapon formed of a stout pole of heavy wood, about 6 feet long, loaded with iron at both ends. It was grasped by one hand in the middle, and by the other between the middle and the end. In the attack the latter hand shifted from one quarter of the staff to the other, giving the weapon a rapid circular motion, and great skill was often shown in dealing or warding off blows delivered with the loaded ends.

QUARTET, or QUARTETTE (Italian *quartetto*, from *quarto*, a fourth), a musical composition for four instruments, generally stringed instruments (that is, two violins, one viola or tenor violin, and one violoncello); also a composition for four voices, with or without accompaniment. All the parts are *obbligati*, that is to say, each is indispensable to the just performance of the piece. In instrumental quartets Haydn opened a new path. Mozart, Beethoven, the two Rombergs, Spohr, Rieck, Onslow, Feska followed.

QUARTZ, the name of a well-known mineral species, which surpasses all others in the extent of its distribution. It is also one of the most comprehensive in the varieties it embraces, which are especially numerous as respects colour, lustre, and fracture. Pure quartz or rock-crystal consists of anhydrous silica, SiO_2 ; it occurs in distinct crystals, or in crystalline aggregation.

The crystals of quartz are, for the most part, regular six-sided prisms, terminated at one or both of their extremities by six-sided pyramids, the faces of which correspond to the sides of the prism, and meet under an angle of $141^\circ 40'$. It sometimes happens that the prism intervening between the two pyramids is very short, or even extinct; in which case the form becomes the dodecahedron, with isosceles triangular faces. In the six-sided prism with pyramidal terminations, we often observe the solid angles, situated between the prism and the pyramid, replaced by rhomboidal planes. The alternate faces of the prism are striated horizontally. The primary form is a rhomboid of $94^\circ 15'$ and $85^\circ 45'$ parallel to whose planes cleavages may be obtained, as also to the planes of the dodecahedron, with isosceles triangular faces, which might also be regarded as the primary form of the species; but the former figure is preferred on account of its simplicity. Lustre vitreous, inclining in some varieties to resinous; colourless when pure, but often exhibiting various col-

ours from admixture of metallic oxides; among the brightest colours are violet-blue, rose-red, clove-brown, and apple-green. Streak white; transparent, translucent, frequently opaque, but never, perhaps, unless occasioned by other minerals; hardness between feldspar and spinelle; specific gravity, 2.65. The crystals often present macles, and sometimes we observe larger crystals, apparently made up of innumerable smaller ones, all of which are so aggregated that their similar faces coincide as respects direction. Implanted globules, reniform and stalactitic shapes, are other modes of occurrence with compound varieties of this species. These have smooth, granulated, and drusy surfaces; composition (mechanical) columnar, often impalpable, and frequently a second time composed into granular or curved lamellar masses. The massive varieties present a granular or columnar, and often an impalpable composition, in which case the fracture becomes conchoidal and splintery. Sometimes a second composition produces indistinct granular or thick lamellar masses. Certain very thin columnar compositions, if cut *en cabuchon*, parallel to the fibres, show an opalescent light. We have pseudomorphous crystals, also, of this species, in the shape of cubes, octahedrons, and various other forms, derived from fluor, calcareous spar, gypsum, &c., besides which quartz occurs in globular and tuberosc masses, formed in vesicular cavities, and also in plates and pebbles.

The principal varieties of quartz, which are known by distinct names, are the following: 1, *rock-crystal*; 2, *smoky quartz*; 3, *yellow quartz*; 4, *amethyst*; 5, *siderite or blue quartz*; 6, *rose quartz*; 7, *milky quartz*; 8, *irised quartz*; 9, *common quartz*; 10, *fat (greasy) quartz*; 11, *flint*; 12, *hornstone*; 13, *Lydian stone*; 14, *floatstone (swimming stone)*; 15, *fibrous quartz*; 16, *radiating quartz*; 17, *chaledony*; 18, *carnelian*; 19, *chrysoprase*; 20, *agate*. The name rock-crystal is applied to transparent and colourless crystals, and more particularly to those of a large size. Smoky quartz consists of those crystals and crystalline masses which are translucent and of a brown colour. Yellow quartz, sometimes called also *Bohemian* or *Scottish topaz*, is transparent, and of various shades of yellow.—Amethyst, also in crystals, and for the most part nearly transparent, is of every shade of violet. Siderite, or blue quartz, is never in regular crystals, but usually compact, and of an azure-blue colour. Rose quartz is confined to translucent massive varieties, of a delicate rose-red colour. Milky quartz is also massive, having an uneven fracture, is translucent, and of a milk-white colour. Irised quartz embraces such crystallized varieties as exhibit in patches, at or beneath the surface, the colours of the rainbow. Common quartz differs from milky quartz simply in being destitute of the milky whiteness of that variety, or in having an inferior degree of whiteness, and more of a vitreous lustre. Fat or greasy quartz differs from common quartz merely in lustre, which, instead of being vitreous, has the appearance of having been immersed in oil. Flint has a more compact texture than common quartz, is dull, only translucent on the edges, of a brownish colour, and breaks with a conchoidal fracture. Hornstone closely resembles flint, from which it can scarcely be distinguished except in its conchoidal fracture, which is much less distinct. When replacing the fibres of wood it is called *woodstone*. Lydian stone, sometimes called *flinty slate*, differs from flint chiefly in having a darker colour, less translucency, and a fracture somewhat slaty; when black it is often called *basanite*. Floatstone consists of a delicate tissue of minute crystals, visible only under a powerful magnifier. Owing to the cavities it contains it sometimes will float on water. Fibrous quartz consists of those varieties

which are in distinct, parallel concretions. Radiating quartz is like fibrous quartz, except that the fibres diverge from a common centre, and resemble the radii of a circle, instead of being parallel. Chalcedony includes those varieties of radiating quartz where the thickness of the individuals becomes so much diminished as to render them nearly or altogether impalpable; its masses generally offer a mammillary or stalactitic surface, and the lustre on freshly-broken surfaces is feeble. Carnelian differs from chalcedony merely in having a blood-red colour. Chrysoprase also resembles chalcedony in composition, excepting that the individuals of which it is made up appear to be grains instead of fibres; its colour is apple-green, from oxide of nickel. Agate implies the occurrence of two or more of the above varieties existing together in intimate union; or it may be applied to a single variety, provided it offers different colours in the same specimens.

Those substances which have formerly been included under quartz, and which are mixtures only of this mineral with other species, are the following: 1, *cat's eye*; 2, *aventurine*; 3, *prase*; 4, *plasma*; 5, *heliotrope*; 6, *iron-flint*; 7, *Compostella hyacinth*; 8, *jasper (red, brown, striped, and porcelain)*; 9, *jasper agate*; 10, *Mocha stone*; 11, *Venus-hair agate*. Cat's eye consists of transparent quartz traversed by exceedingly delicate parallel fibres of asbestos; when cut *en cabuchon* it exhibits, as its position is altered with respect to the eye, a peculiar play of light upon its surface, resembling the changeability of light seen in the eye of a cat. Aventurine is quartz penetrated by small golden-coloured spangles of mica. Prase is quartz penetrated by green fibres of hornblende, which are often so small as to escape detection by the naked eye, and their presence is only discoverable from the green colour they impart. Plasma is a variety of chalcedony, coloured leek-green, and having yellow and white spots. Heliotrope is likewise a variety of chalcedony, but coloured by green earth, and occasionally dotted with minute portions of red jasper. Iron-flint consists of quartz, intermingled throughout with oxide of iron. The *Compostella hyacinth* is a red variety of iron-flint, in regular six-sided prisms, with pyramidal extremities, which occurs imbedded in gypsum. Jasper differs from the two last varieties in being massive, and in containing variable proportions of clay. Red and brown jasper simply allude to the colour of the compound. Striped jasper appears to contain a larger portion of clay, and is distinguished on account of its striped delineations. Porcelain jasper is regarded as silicious slate altered by heat, and is found in the vicinity of coal-mines. Those varieties which are found in rounded masses, and which, from the concentric layers of which they consist, appear to have been formed in open spaces, are called *Egyptian jasper*. Jasper agate consists of those varieties of jasper in which several colours are so arranged as to produce an agreeable effect. Mocha stone consists of agate containing appearances of vegetable filaments, which have been occasioned through the infiltration of iron and manganese through its crevices. Venus-hair agate consists of quartz traversed by delicate hair-shaped crystals of any kind. Quartz is infusible before the blowpipe. It is dissolved by soda easily, and with effervescence. Two pieces rubbed together emit an empyreumatic odour and a phosphorescent light. Crystals of quartz may be obtained from a solution of silica in hydrofluoric acid, or in potash diluted with water. The fluid from which crystals of this species are formed, in geodes and other natural cavities of rocks, has been observed to be chiefly water.

With respect to the distribution of quartz (which we have remarked above to be the most abundant

mineral known), it may be said that common quartz enters into the regular mixture of various rocks, of granite, gneiss, mica slate, topaz rock, &c. In others it occurs in single crystals and in grains, as, for instance, in porphyry, and is frequently met with in the vesicular cavities of amygdaloidal rocks. In these last situations in particular are found the finest varieties of chalcedony, carnelian, of jasper and agate. Hornstone forms globules and irregular veins in compact limestone; and flint occurs in a similar manner, but disposed through vast beds of chalk. Quartz also occurs in rocks of which it does not form a regular ingredient; sometimes in masses that are open in their interior, and lined with crystals of enormous size. It also exists in beds by itself, as in quartz-rock, and some varieties of sandstone. Striped jasper and flinty slate form also particular beds. The varieties prase and chalcedony, as well as amethyst, are often found in beds of iron ore. River sand, and that of extensive plains, where it is sometimes so fine as to drift before the wind, are formed chiefly of quartz. Common quartz, and several other varieties, are spread all over the earth, but certain varieties are confined to a few localities. The finest and largest rock-crystals are found in the Alps of Salzburg, the Tyrol, Switzerland, Dauphiny, Piedmont, and Savoy; and especially in Madagascar, in Ceylon, and in Brazil. Early in the eighteenth century a cavity containing rock-crystals in great quantity was discovered in the Austrian Alps, the total weight amounting to 1000 cwts. One crystal weighed 8 cwts.; others from 4 to 5. The Alps have furnished perhaps the finest specimens of smoky quartz. This variety has also been brought in large crystals and crystalline masses from Nova Scotia. Yellow quartz often comes from Brazil and Bohemia. A variety, intermediate between smoky and yellow, is found in the Cairngorms in Scotland. Amethysts of various colours are brought from Brazil, but those of the finest colours come from Ceylon, India, and Persia. A variety intermediate between amethyst and smoky quartz is found in Siberia. Amethyst also abounds in Transylvania and Hungary. Few localities of this beautiful variety are known in North America. Nova Scotia affords it in limited quantity; and a spot near Bristol, in Rhode Island, deserves to be mentioned for the fine crystals it has produced. Rose quartz occurs at Rabenstein, in Bavaria, and in Siberia; but no locality produces in so great perfection as that at Paris, in Maine. Prase comes from the mining district of Schwartzberg, in Saxony, and from Cumberland, in Rhode Island. Smalt-blue chalcedony, sometimes in pseudomorphous crystals, occurs at Tresztyan, in Transylvania; the stalactitic shapes are found in Iceland and the Faroe Islands in amygdaloid, at Huttenberg and Loben in Carinthia; also in Hungary, Scotland, and Cornwall. Carnelian is brought from Arabia, India, Surinam, and Siberia. Chrysoprase exists at Rosemutz in Silesia, and at Newfane in Vermont. At this last-mentioned locality are found small prismatic crystals of quartz, deeply tinged by oxide of nickel. Chalcedony and carnelian are occasionally found, constituting very handsome agates, near Deerfield in Massachusetts, and at Southbury in Connecticut; they are also brought from Nova Scotia—in each of which places they occur in trap. Plasma is found in Moravia and in Bavaria. Flint is common in England, France, Poland, and Spain. Hornstone is abundant in many countries. Flinty slate forms beds, and occurs in pebbles in Bohemia, Silesia, Saxony, the Western States of the United States, and in the Canadas. Fibrous quartz is found in the Hartz; cat's eye in Ceylon and the coast of Malabar; and aventurine at the Cape de Gat, in Spain. Heliotrope

was formerly brought from Ethiopia, but is now generally obtained from Bucharra, from Tartary, and Siberia. Iron-flint, or ferruginous quartz, is frequent in the ironstone veins of Saxony, Bohemia, Hungary, Transylvania, &c. The Compostella hyacinth occurs near Compostella, in Spain. Striped jasper is found in Siberia, at Grandstein in Saxony, at Ivybridge in Devonshire; the brown Egyptian jasper comes from the banks of the Nile; the red variety from Baden, also from the town of Saugus, near Boston, in Massachusetts.

Several varieties of quartz are of important use in the arts and manufactures, and have long been employed for purposes of decoration and utility by mankind. The ancients regarded rock-crystal as petrified water; they esteemed it particularly for the fabrication of vases, especially when it could be procured in large pieces. Such were the two cups which Nero dashed to pieces when he received the news of the revolt which caused his ruin, one of which had cost him a sum equal to £875. At present it is esteemed not only for cups, urns, chandeliers, but for seals, spectacle-glasses, and optical instruments. Amethyst takes a fine polish, and is much employed in jewelry. Its colour, when dark blue, is well adapted to that of gold, in which metal it is always set. The ancients were much in the habit of engraving upon this variety of quartz. The rose quartz is cut into vases and cups, and when of a delicate colour, and free from flaws, is highly esteemed. The yellow quartz is one of the most frequent stones employed for watch seals, having almost entirely supplanted the carnelian, which was formerly so much in vogue; it is called *topaz* by the jewellers. Chalcedony receives a high polish, exhibiting a slight degree of unctuousity. The ancients have left us many beautiful specimens of this variety of quartz, wrought into cameos and cups. They obtained it from the region of the Nasamones, in Africa, and from the environs of Thebes, in Egypt. The Japanese cut an immense quantity of carnelian into the form of the fruit of the olive, which they perforate, to be worn as beads. The carnelians which are sold at Bombay are brought from the province of Guzerat, in India, and the finest pieces come from the Gulf of Cambay. Lapidaries distinguish two varieties of carnelian, namely, those having a pale colour with a tinge of yellow, and those of a lively and deep-red colour. The last are the most rare, and the most highly esteemed, also, on account of their beauty. The Japanese are said to possess the art of heightening the colour of the pale carnelians. What is called *white carnelian*, is simply chalcedony. The carnelian was much in vogue among the Romans; and the moderns possess numerous specimens of ancient workmanship in this stone. The sardonyx (an intermixture of chalcedony and carnelian, the colours fading gradually together, and not arranged in distinct lines) was also in high estimation, in early times, and still continues to be employed in jewelry. The onyx, or banded agate, which exhibits two, three, or more colours, disposed in parallel lines, constituted the most valuable material for the exercise of the glyptic art, as the workman was enabled to make use of the different colours to represent his subject in a natural manner; for example, white and red were devoted to the representation of human flesh, while black, green, yellow, &c., were appropriated to drapery and other objects. The onyx, as well as the heliotrope and agatized wood, are also cut into thin plates for various kinds of inlaid work. The most important applications of this species to useful purposes depend upon its being composed of silica. Quartz enters into the composition of glass, both white and coloured.

In the manufacture of porcelain it is added in the state of an impalpable powder, and forms part of the paste; it is also used in other kinds of pottery. Quartz is used as a flux in the melting of several kinds of ores, particularly those of copper, and in other metallurgical processes. The use of flint in gunlocks is well known. Touchstone is a kind of bituminous quartz.

QUASSIA, a genus of American tropical plants of the natural order Simarubaceae. The wood of two species is known in commerce by the name of *quassia*. One of these, *Quassia amara*, is a native of Panama, Venezuela, Guiana, and Northern Brazil; the other, *Q. excelsa* (or *Picranea excelsa*), is a native of the West Indies; both are bitter, and possess tonic properties. The former was once commonly used medicinally, but in Britain the latter is now used instead, its wood supplying the quassia chips or quassia wood of the druggist. Quassia is used to some extent instead of hops in brewing, but this use is forbidden in Britain. In France and Germany the *Q. amara* often takes the place of the other species. The bark of the root of *Simaruba amara*, an allied tree of similar properties, is sent to Europe for medicinal purposes. The timber of this tree is described as resembling white pine in quality and colour.

QUATERNIONS, the name given by Sir Will. R. Hamilton to a method of mathematical investigation discovered and developed by him. It is most important in its applications to physics, especially in crystallography, optics, kinematics, and electro-dynamics. This calculus is eminently simple and natural in its treatment of problems. (See Hamilton's *Lectures and Elements*; see also the treatises of Tait and Kelland and Tait.) The most striking peculiarity of the calculus is that multiplication is not generally commutative; that is, qr is in general different from rq , r and q being quaternions. It may be said that quaternions includes all the successful attempts which have been made to represent the imaginary factor of algebra $\sqrt{-1}$. This factor indicates a change in direction, through one right angle, of a line, and we see that the expression $a + b\sqrt{-1}$ represents a point whose co-ordinates are a and b . Now Hamilton saw that to enable his calculus to deal with space indifferently in all directions he could not indicate any one direction in space by real numbers, and he uses imaginary expressions to indicate every direction; his method is therefore independent of any supposed directions in space, and takes its reference lines solely from the data of the problem to which it is applied. In fact, when using quaternions, we deal with geometrical lines as we deal with them in our thoughts, and hence the simplicity and directness of this method of investigation.

Any expression, as \overline{AB} , denoting a line in direction as well as in length, contains implicitly three numbers; and all lines parallel and equal to the first depend in the same way on the same three numbers. Hence all equal and parallel lines may be represented by a common symbol, and this symbol contains three distinct numbers. In this sense a line is called a *vector*, since by it we pass from one extremity A to the other B ; it is, in fact, an instrument which carries A to B , and a vector is used to indicate a definite translation in space. We find that two vectors are compounded as two velocities or two forces are compounded in mechanics, and also that any vector may be resolved into three components, parallel respectively to any three given non-parallel vectors not in the same plane. Hamilton employs as lines of reference a series of three mutually perpendicular unit vectors, denoted by i, j , and k . What has just been

said with regard to vectors enables a great number of difficult geometrical problems to be solved readily; for instance, such problems as are given as exercises in modern geometry. When two vectors are parallel, their ratio is simply the ratio of their lengths; that is, one may be obtained from the other by the use of the instrument, an ordinary numerical multiplier. But consider the instrument which changes the vector $O A$ into the vector $O B$; we shall find that $O A$ must be subjected to four distinct operations before it can be changed into $O B$; an increase or diminution in length, and then the turning of it from its present direction to that of the line $O B$. To specify this turning process, mathematicians know that three numbers are required. Thus, the ratio of two vectors, or the multiplier required to change one vector into another, in general depends upon four distinct numbers, whence the name quaternion. The order in which these two distinct operations is performed is immaterial. The stretching factor, or that which performs the first operation, is called the *tensor*, and the turning factor is called the *versor*. Here we have regarded a quaternion as the product of a tensor and a versor, but it may also be regarded as the sum of a numerical quantity and a vector; the numerical quantity is called a *scalar*. The proof of this property, as given by Tait, is very simple. Known properties of the tensors, versors, scalars, and vectors of products and quotients of vectors may be interpreted in a vast number of ways, and it is in this that we discover the great power of the calculus.

QUATRE-BRAS, a village of Belgium, in the province of South Brabant, 20 miles S.S.E. of Brussels, situated at the intersection of the main roads between Brussels and Charleroi, and from Nivelles to Namur. It is famous for the battle fought here (16th June, 1815) between the English under Wellington and the French under Ney. It was Napoleon's plan at the opening of the campaign of 1815 to fight the armies of the allies singly, as he felt himself unable to cope with their combined forces. At the head of an army of 129,000 men, supported by 350 guns, he made a rapid march into Belgium, crossing the Sambre almost before the allies were aware of his movements. His army was divided into three corps: the right wing, 48,000 strong, being under Grouchy; the centre, of 28,000 men, under the emperor himself; and the left wing, of 48,000, under Ney. The Prussians and English under Blücher and Wellington lay between the French and Brussels. With the right wing and centre of his army Napoleon furiously attacked the Prussians, who, after a severe struggle, retired upon Wavre (16th June). On the same day Ney attacked Wellington at Quatre-Bras. The English, 32,000 strong, repulsed Ney, and maintained their position, though at a loss of over 5000 men, including the Duke of Brunswick. The English general, hearing of the retrograde movement of the Prussians, fell back on the 17th on Waterloo, where the decisive battle was fought on the following day.

QUAVER. See MUSIC.

QUAY, a landing-place along a line of coast or a river bank, or round a harbour, and having posts and rings, frequently also cranes and storehouses, for the convenience of ships. They are usually constructed of stone, but sometimes of wood and iron.

QUEBEC, a city of the Dominion of Canada, capital of the province of Quebec, and third largest city of the Dominion, situated on the north bank of the river St. Lawrence, in the angle at the junction of the St. Charles, about 850 miles by water from the Atlantic Ocean and 150 miles north-east of Montreal. The St. Lawrence here is about a mile wide, but broadens out a short distance below the

city, where the Island of Orleans divides the stream into two channels. The city occupies a grand site amid grand scenery, the Upper Town crowning a noble promontory, a striking feature of which is Cape Diamond. The Upper Town and its suburbs are mainly situated on a lofty plateau which descends steeply towards the south, east, and north, and merges westward in the Plains of Abraham; while on the narrow strip of low land along the St. Lawrence at the southern base of the heights, and on the broader strip at the eastern foot of the plateau, the Lower Town is built. Northwards from the Upper Town to the St. Charles River there extends a broad stretch of low-lying ground covered by the suburb of St. Roch. At the angle between the two rivers there are a tidal basin and a wet dock (Louise Basin). The Upper Town proper is inclosed by a wall nearly three miles long and mounted with guns. Formerly three gates, Prescott, Palace, and Hope, communicated with the Lower Town, and two, St. Louis and St. John, with the western suburbs, but of these only one, St. Louis, and that in a modernized form (1879), remains. The Kent gate and St. John's gate are also modern. The citadel, near Cape Diamond, on the southern edge of the plateau, over 300 feet above the river, is still a strong fortress, but is chiefly of use as a barrack. There are four martello towers to the west of the city, outside of the walls. The Lower Town is the chief business part of the city, and contains few buildings of note beyond the Champlain Market, the Finlay Market, the custom-house, the three railway-stations, and the church of Notre Dame des Victoires, a building erected during the French régime. The Upper Town possesses a quaintly picturesque character, with numerous narrow streets. Dufferin Terrace, a broad built-up promenade a quarter of a mile long extending along the ramparts east of the citadel, and about 200 feet above the river, commands a magnificent view. At the eastern end of it stands a splendid hotel, known as Château Frontenac. At the Place d'Armes, behind the hotel, are the old court-house and the English cathedral, the latter a handsome building erected in 1804; and almost in the heart of the walled town is the very extensive Ursuline convent, built originally in 1639, containing some fine pictures and also the remains of Montcalm. A group of important buildings in the extreme east consists of: the Basilica, or Roman Catholic cathedral, founded in 1666 and rebuilt about a century later; the Cardinal's Palace; the Seminary of Quebec, founded in 1663; and Laval University, the chief French university of the Dominion, with a good museum and library and a valuable collection of pictures. The other chief buildings and institutions within the walls are: the city-hall; the Hotel Dieu, a convent and a hospital; St. Patrick's church (R.C.); St. Andrew's church (Church of Scotland); the Wesleyan chapel; the Congregational church; the Baptist church; Trinity church (Episcopal); Chalmers Presbyterian church; the post-office; Morrin College, a Protestant institution containing the library of the Literary and Historical Society; the garrison club; and the cavalry barracks. The Governor's Gardens, with a column (1827-28) in memory of Wolfe and Montcalm, and the Esplanade are open spaces within the walled city. In the Upper Town, but outside the walls, are the following edifices and institutions: the Parliament buildings, an imposing quadrangle in gray stone; Nazareth Orphan Asylum; the Y.M.C.A. building; the Jeffrey Hale Hospital; the Grey Nuns' convent; St. Vincent de Paul and St. John the Baptist Roman Catholic churches; St. Matthew's Episcopal church; the Good Shepherd Convent; St. Bridget's Asylum; the Ladies' Protestant Home; the gaol;

and the Wolfe Monument, a tall marble shaft erected near the spot where the famous leader fell. The St. Roch suburb contains St. Sauveur and St. Roch Roman Catholic churches, the general hospital, the marine hospital, and the convent of the Sisters of the Congregation. Other suburbs less closely associated with the town are Limoilou, on the left bank of the St. Charles; Levis, on the right bank of the St. Lawrence and connected with Quebec by steam ferries, with a graving-dock and strong forts; New Liverpool, also on the right bank of the St. Lawrence; and Beauport, with the lunatic asylum. The main streets of the city are traversed by electric tramways, and the city is lighted by electricity. Quebec is a terminus of the Quebec and Lake St. John and Quebec, Montmorency, and Charlevoix Railways, and of a branch of the Canadian Pacific Railway; and Levis is on the Quebec Central, the Intercolonial, and the Grand Trunk lines. The formerly flourishing shipbuilding industry and trade in timber have greatly declined, but tanning and the manufacture of boots and shoes are carried on, and cotton is manufactured at the Montmorency Falls, a little below the town. The annual value of the imports is fully £1,000,000, of the exports about the same.

Jacques Cartier visited the St. Lawrence in 1535, and found an Indian village called Stadacona on the site of the present city of Quebec. On July 3, 1608, Samuel Champlain founded the first European settlement on the site, and it at once became the headquarters of New France. The city was taken by the British in 1629 and was held by them till 1632, when it was restored to France. It remained thenceforward in French possession until Sept. 13, 1759, when it passed finally under British authority as the result of the great battle on the Plains of Abraham, in which Wolfe defeated Montcalm, both generals being mortally wounded. In 1763 the Treaty of Paris recognized British authority in Canada. On Dec. 31, 1775, a force of the revolted Americans failed in an attack upon the fortress and lost their general, Montgomery, in the action. Quebec is still the centre of French Canada, and the great majority of its inhabitants are French and Roman Catholic. Pop. in 1891, 63,090; in 1901, 68,840.

QUEBEC, an eastern province of the Dominion of Canada, bounded on the N. by Ungava district; on the E. by Labrador and the Gulf of St. Lawrence; on the S. by Chaleur Bay, New Brunswick, and the states of Maine, New Hampshire, Vermont, and New York; and on the S.W. by the river Ottawa, which separates it from the province of Ontario. It is over 1000 miles in greatest length by 500 in greatest breadth, and has an area of 228,900 square miles. The surface is very varied, being diversified by mountains, rivers, lakes, and extensive forests. The chief mountains are the Notre Dame or Shickshock Mountains, extending along the south side of the St. Lawrence, and forming a table-land 1500 feet high, with peaks rising to the height of 4000 feet; and the Laurentian Mountains, or Laurentides, which stretch from the coast of Labrador to the Ottawa River, and rise to a height of from 1200 to 4000 feet. The chief islands are Anticosti, at the mouth of the St. Lawrence, and the Magdalen Islands in the Gulf of St. Lawrence. The chief river is the St. Lawrence, which flows through the entire length of the province. Next to it in importance is its chief tributary, the Ottawa, over 700 miles in length. The other largest rivers are the St. Maurice and the Saguenay. The province boasts many beautiful lakes, the chief being Mistassini, Temiscamingue, and Lake St. John, from which issues the Saguenay. The climate is variable, though salubrious, the temperature ranging from 20° below zero in winter to

90° in summer. The soil is generally fertile, and well suited for the growth of cereals, hay, &c.; maize, flax, and tobacco are also grown, especially to the west of the longitude of Quebec; while grapes, melons, peaches, and tomatoes in this region come to maturity in the open air. A large portion of the province is still covered with forest, the white and red pines and the oak being the most valuable trees for timber. The fisheries are extensive and valuable. The minerals worked include apatite, asbestos, gold, copper, iron, plumbago, &c. The manufactures are steadily increasing, and include furniture, leather, paper, chemicals, boots and shoes, woollen goods, steam and agricultural machinery. The chief exports are timber and fish. The educational system embraces institutions of all grades, from primary schools upwards, at the top being three universities—Laval University, Quebec (Roman Catholic); McGill University, Montreal (Protestant); and Bishop's College, Lennoxville (Anglican). The affairs of the province are administered by a lieutenant-governor (appointed by the governor-general), a legislative council composed of 24 members, and a legislative assembly of 74 members, elected by the people for five years. The province sends 24 members to the Dominion Senate and 65 to the Dominion House of Commons. The capital is Quebec, but Montreal is the largest town. Pop. in 1881, 1,359,027; in 1891, 1,488,535; in 1901, 1,648,898, the great majority being Roman Catholics of French descent.

QUEDAH, or KEDDAH, a small state on the west coast of the Malay Peninsula, lying immediately to the north of Province Wellesley. It is a well-wooded and mountainous country, with an area of about 3600 square miles. There are numerous rivers. The climate is warm but healthy. The more important agricultural products are rice and pepper, but the chief wealth of the state consists in its tin. The capital is a town of the same name, with a population of 6000. The state has a population of about 30,000.

QUEDLINBURG, a town in the Prussian government of Magdeburg, province of Saxony, situated at the foot of the Harz Mountains, 35 miles south-west of the town of Magdeburg. It is partly surrounded by an old wall with towers, has an interesting old town-house, &c. On an eminence above the town is an old castle, once the residence of the abbesses of Quedlinburg, who, as princesses of the empire, had a vote in the diet. One of them was the mistress of the King of Saxony, and mother of the celebrated Marshal Saxe. The manufactures of Quedlinburg are woollens, beet-root sugar, leather, wire, chemicals, beer, &c. The poet Klopstock was born here. Pop. in 1880, 18,437; in 1895, 21,971; in 1900, 23,378.

QUEEN (Anglo-Saxon, *cwen*, a wife), the wife of a king. In Britain the queen is either *queen-consort*, or merely wife of the reigning king, and is in general (unless where expressly exempted by law) upon the same footing with other subjects, being to all intents the king's subject, and not his equal; or *queen-regent*, regnant, or sovereign, who holds the crown in her own right, and has the same powers, prerogatives, and duties as if she had been a king (see BRITAIN), and whose husband is a subject, and may be guilty of high treason against her; or *queen-dowager*, widow of the king, who enjoys most of the privileges which belong to her as queen-consort. It is treason to compass or imagine the death of the queen-consort, and to violate or defile her person not only renders the person committing the act guilty of treason, but the queen herself, if consenting. If the queen be accused of treason she is (whether consort or dowager) tried by the House of Peers. Queen Caroline was

proceeded against by a bill of pains and penalties. Before the law a queen-consort has a different position with reference to her husband from any other woman. Her civil rights and abilities are not merged in those of her husband, and she is in fact, in most respects, considered not as a *feme covert*, but as a *feme sole*. A queen-dowager enjoys most of the privileges that belong to her as queen-consort; but it is not treason to compass or imagine her death or to violate her chastity, because no danger to the succession is thereby incurred. If she marries a subject she still retains her royal dignity, but no man can marry her without a special license from the crown, on pain of forfeiting his lands and goods. By act of Parliament (1837) Queen Victoria was granted, in return for the surrender of the crown lands to Parliament, an annual allowance of £385,000. By an act of 1901 the civil list of Edward VII. was fixed at £470,000, of which Queen Alexandra's share is included in the amount of £110,000 appropriated to the privy purse. In Prussia, Sweden, Belgium, and elsewhere, the succession being confined to the male line, there can be no queen regent. (See *SALIC LAW*.)

QUEEN ANNE'S BOUNTY, a fund applied to the increase of the incomes of the poorer clergy of the Church of England, and to aid incumbents in rebuilding parsonages by granting advances of money, in virtue of a royal charter confirmed by 2 and 3 Anne, cap. xi., by which the first-fruits (the whole income of an incumbency for the first year after a new appointment) and the tenths (a tenth of the annual income of every incumbency, both tenths and first-fruits being calculated on the old valuation), which before the Reformation had been paid to the pope, but had been annexed to the crown by Henry VIII., were assigned to a corporation created by the act and intrusted with the duty of administering the fund for the purpose mentioned. The corporation that administers the fund has authority to make rules for its distribution. The principal rules that it has established are, that no sum over £200 is to be granted for the augmentation of any single living, and that the grants are to be made in the first instance to those livings not exceeding £10 a year, then to those not exceeding £20 a year, and so on as long as there are any livings under £50 a year. But when any private benefactor advances £200 for the augmentation of a particular living the corporation adds to that other £200, provided the living is not above £45 in yearly value. The fund amounts to more than £4,000,000.

QUEEN CHARLOTTE ISLANDS, a group of islands in the North Pacific Ocean, off the coast of British Columbia, north of Vancouver Island. It consists of two larger and several smaller islands. The northernmost of the two larger islands is called Graham Island and the southernmost Moresby Island. The greatest length of the two together is about 160 miles, and the greatest breadth (of the northern island) about 70 miles. The climate is excellent. The islands are covered with magnificent forests, and are rich in minerals. Gold-bearing quartz of rich quality has been found, and copper and iron ores and a fine vein of anthracite coal also exist. On the coast are numerous creeks suitable for harbours. Queen Charlotte Islands were first seen by Captain Cook about 1770, and were taken possession of by Britain in 1787. They are inhabited by about 2000 Indians.

QUEEN CHARLOTTE SOUND, a channel in the North Pacific Ocean, separating Vancouver Island from the mainland of British America on the north, and forming the commencement of a long series of inlets continued along the north and east of the island.

QUEEN'S BENCH, **KING'S BENCH**, **COURT OF**, a separate law court formerly existing in England, which was considered as the most direct successor to the *aula regis* or great court established in the Norman period, and divided into several branches for the trial of different kinds of pleas. In this court, which is now a division of the High Court of Justice created by 36 and 37 Vict. cap. lxi. (1873), and is presided over by the Lord Chief Justice of England, the sovereign was, by a fiction, supposed to preside in person, and the writs were accordingly made returnable 'before the king [or queen], wherever he may be in England,' because the court formerly followed the king to different parts of the kingdom, and was once held, in the twenty-first year of Edward I., at Roxburgh in Scotland. But for many centuries its sittings were held in Westminster Hall, and the king never presided in it. The three courts of Westminster Hall—King's Bench, Common Pleas, and Exchequer—originally had jurisdiction of distinct kinds of actions, the King's Bench having cognizance of criminal suits, the Common Pleas of suits between party and party respecting land-titles and on contracts, and the Exchequer in matters of revenue. But latterly the Queen's Bench drew to itself cognizance of actions of almost all descriptions, and took cognizance both of criminal and civil causes. The department of the courts that took cognizance of criminal cases was called the crown side or crown office, and that which acted in civil causes the plea side. The Queen's Bench had also supervision of all the inferior courts of common law throughout the kingdom, from all which a writ of error lay to this court, and from any of which it might at its own pleasure remove any case by a writ of *certiorari*. It might also punish magistrates and officers of justice for wilful and corrupt abuses of their authority; and in order to determine the title by which any person held some civil office, franchise, or liberty, might, by a writ of *quo warranto*, demand of any claimant to such office or privilege by what authority he supported his claim. Another important writ issued by this court was that of *habeas corpus*. As a division of the High Court of Justice the Queen's Bench exercises the same functions as it did when it was an independent court. By the 34th section of the act above cited there are assigned to this division all causes and matters civil and criminal pending in the Court of Queen's Bench at the commencement of the act, and all causes and matters civil and criminal which would have been within the exclusive cognizance of the Court of Queen's Bench in the exercise of its original jurisdiction if the act had not passed. To the Queen's Bench division belong fourteen justices (besides the Lord Chief Justice), each with a salary of £5000 a year. *SEE SUPREME COURT OF JUDICATURE*.

QUEEN'S COLLEGE, Cambridge, was founded in 1448 by Margaret of Anjou, queen of Henry VI., and again in 1465 by Elizabeth, queen of Edward IV. It consists of a president and thirteen foundation fellows. The latter retain their fellowships unconditionally for seven years from election; but no fellow can retain his fellowship for more than one year after his institution to a college living the net annual value of which is above £400. A fellow of the college who holds a professorship in the university, or the office of public orator, may retain his fellowship as long as he continues to hold such office; and fellows holding certain offices within the college have special privileges in respect of the tenure of their fellowships. A fixed proportion of the revenues of the college is paid to a scholarship fund. Six of the scholarships are conferred after examination, and are open to all persons under nineteen years of age who

have not commenced residence in the university at the time of the examination. There are nine church livings in the gift of the college, and one in that of the president, who must nominate to it one of the eight senior divines. There are in addition four exhibitions named after their founders, and the president distributes £180 per annum in grants to deserving students of limited means. The college buildings are among the most interesting in the university, and include four courts of small size. The gallery of the president's lodge is 80 feet long and has three quaint oriel windows. In a tower in the Pump-court are the rooms inhabited by Erasmus (1506). John Fisher, Thomas Fuller, and Bp. Pearson were members of the college.

QUEEN'S COLLEGE, Oxford, was founded in 1840 by Robert Eglesfield, chaplain to Philippa, queen of Edward III., and it is from her that it gets its name. The subsequent foundations of John Michel, Sir Francis Bridgman, and Lady Margaret Hungerford were consolidated into one with that of Eglesfield in 1858; and the college, under statutes framed by the Oxford University Commissioners in 1882, now consists of a provost, from 14 to 16 fellows, about 25 scholars, and two Bible-clerks. The scholarships are of the annual value of £80, and are tenable for five years; candidates must be under nineteen years of age. The Bible-clerkships, which are also tenable for five years, are of the annual value of £80, and their holders occupy rooms rent-free. Six of the scholarships are called Eglesfield scholarships, and are to be awarded, in case suitable candidates offer themselves, to natives of Cumberland and Westmoreland. There is also a scholarship called the Jodrell scholarship, of the annual value of £90, and tenable for four years; and a considerable number of other exhibitions. The college presents to twenty-three church-livings.

QUEEN'S COLLEGES, Ireland. These colleges are three in number, situated at Belfast, Cork, and Galway, and were chartered in 1849 in pursuance of an act of Parliament passed in 1845 (8 and 9 Vict. cap. lvi.), enabling the queen to endow new colleges for the advancement of learning in Ireland, and granting £100,000 out of the consolidated fund for establishing the same. The colleges were opened in 1850, being connected with Queen's University, then also instituted as a degree-conferring body. The constitution of each college is the same. The corporate body of each consists of the president and professors, and the general government and administration are vested in a council consisting of the president and six members, elected by the professors from among themselves. The elective members of council hold office for three years, the two senior ones retiring every year, and a new election taking place to fill the vacancies. There is an appeal from the decisions of the council to the visitor, who is appointed by the crown by sign-manual. Every student attending any of the colleges must dwell with his parent or guardian, or some near relation, or in lodging-houses approved by the council of the college. Deans of residences are appointed, and are required, among other things, to make provision for securing to the students the means of due attendance upon such religious instruction and divine worship as may be approved by the parents and recognized by the college authorities; and students habitually neglecting divine worship and religious instruction are liable to expulsion. The session of the Queen's Colleges extends from October to June. In their first session the students in arts study English, Greek, Latin, a modern language, and mathematics. In the second session logic, natural history, and two of the following, viz.:—Greek (second course), Latin

(second course), a modern language (second course), and mathematics (second course). In the third session they study the English language and literature; metaphysics, or history, or political economy; chemistry; zoology, or botany. Students who are preparing to compete for university honours are allowed to substitute any two courses of lectures specifically designed for honour candidates for two of the courses above set down for study in the third session. The number of students attending during the session of 1901 was 627.

Students of the Queen's Colleges in Ireland may obtain degrees in arts, medicine, and law from the Royal University of Ireland by observing the course of studies prescribed by that body, and passing the requisite examination. This university was founded in pursuance of the provisions of the University Education (Ireland) Act, 1879, and has now superseded the Queen's University in Ireland, it being provided that the graduates and students of the latter university shall have similar rank in the new university. The Royal University corporation consists of a chancellor, a senate, and graduates. The government is vested in a senate consisting of a chancellor, and senators (the latter not to exceed thirty-six in number), with power to grant all such degrees or other distinctions as can be conferred by any university of the United Kingdom, except in theology. The charter gives power to grant such degrees to all male and female students who shall have matriculated in the university, and passed the requisite examinations prescribed by the senate, and provides that no residence in any college, nor attendance at lectures, or any other course of instruction in the university, shall be obligatory on any candidate for a degree, other than a degree in medicine or surgery, the university in this respect resembling that of London. The act 44 and 45 Vict. cap. lii. provides for the payment of £20,000 a year out of the surplus funds of the Irish Church for the purposes of the university, which has its seat in Earlsfort Terrace, Dublin.

QUEEN'S or KING'S COUNSEL, barristers appointed counsel to the crown, and 'called within the bar'. They have precedence over the other barristers, being regarded as of higher rank than those who are the ordinary or 'outer' barristers or junior counsel; and they rank among themselves according to seniority. They are appointed by patent from the crown on the nomination of the lord-chancellor. They cannot be employed against the crown without special license, but this license is always granted (on payment of a fee) unless the crown itself desires to retain the counsel on the case with reference to which the application is made. In this respect they resemble the *advocati fisci* of the Romans, who, however, under the empire were still more restricted in their practice, not being allowed to serve at all in any case between subject and subject. By 13 and 14 Vict. cap. xxv. queen's counsel were enabled to act as judges of assize when named in the commission. It is the established etiquette of the profession that no king's counsel conducts any case without the assistance of a junior counsel. Their professional robes are of silk instead of stuff like those of ordinary barristers, and hence the phrase 'to receive the silk gown', or 'to take silk', is often used in the sense of 'to be raised to the rank of king's counsel'. The first to be appointed to the rank of queen's counsel was Sir Francis Bacon in 1590. Formerly these barristers received a small salary.

QUEEN'S COUNTY, an inland county in Ireland, in the province of Leinster, bounded on the north-west and north by King's County, east by Kildare and a detached portion of King's County,

south-east by Carlow, south by Kilkenny, and south-west by Tipperary; area, 424,852 acres. The surface is generally flat, rising in the north-west into the Slieve-Bloom Mountains, whose highest summit, Arderin, is 1784 feet above sea-level. In the south-east are the Dysart Hills, consisting chiefly of a series of isolated eminences. The first are composed principally of sandstone, and a part of the second of the anthracite coal-measures, which are here worked to some extent. Iron, copper, and manganese are found, but not worked. Limestone abounds, and in a few places marble is obtained. The soil is fertile except where bogs occur, but these are pretty numerous towards the centre of the county. Principal rivers, the Barrow and Nore, both of which rise in the Slieve-Bloom Mountains. There is only one lake in the county, Lough Annagh, with a length of about 1 mile. Agriculture is not generally in an improving state, drainage in particular being much wanted. The principal crops are oats, barley, potatoes, turnips, and mangel-wurzel. Fully half of the total area is in pasture, and rather less than a third is under tillage. Some 60,000 acres are bog, mountain waste, &c., and about 10,000 are under plantations. Two branches of the Grand Canal traverse the county, and the Great Southern and Western Railway crosses it from N.E. to S.W. Principal towns, Maryborough (the county town), Mountmellick, and Portarlington, the last partly in King's County. Queen's County returns two members to Parliament. Pop. (1841), 153,930; (1881), 73,124; (1891), 64,883; (1901), 57,226.

QUEENSFERRY, NORTH, a village of Scotland, Fifeshire, 6 miles S.S.E. of Dunfermline, on the north shore of the Firth of Forth, opposite South Queensferry. It is frequented for summer and sea-bathing quarters. Pop. (1891), 410.

QUEENSFERRY, SOUTH, a royal burgh and seaport town of Scotland, in the county of Linlithgow, 8 miles west by north of Edinburgh, on the south side of the Firth of Forth, at a point where the latter suddenly narrows to a width of about 2 miles, and almost as suddenly again expands to a breadth of nearly 4 miles. The ferry at this point was at one time the principal means of communication between Edinburgh and the north of Scotland. The celebrated railway bridge spanning the Firth of Forth is here. (See FORTH BRIDGE.) Queensferry is one of the Stirling district of burghs. Pop. (1891), 1531; (1901), 1845.

QUEENSLAND, an Australian colony (or state), established in 1859, and occupying the north-eastern portion of the Commonwealth, north of New South Wales and South Australia, and east of the latter. The boundaries inland are mostly artificial—the meridians of 138° and 141° E., and the parallels of 29° and 26° S.—on the east it has the Pacific, on the north the Gulf of Carpentaria. The most northern part of it, forming York Peninsula, extends to Torres Strait, and a considerable portion is within the tropics. It has an area of about 668,224 square miles, and is divided into twelve large districts (besides smaller divisions), namely, Moreton, Darling Downs, Burnett, Port Curtis, Maranoa, Leichhardt, Kennedy, Mitchell, Warrego, Gregory, Burke, and Cook. The coast is well supplied with bays or inlets and harbours, some of the chief being: Moreton Bay, Hervey Bay, Port Curtis, Keppel Bay, Broad Sound, Repulse Bay, Halifax Bay, Rockingham Bay, Princess Charlotte Bay. Of the numerous islands along the coast the following are worthy of mention: Stradbroke, Moreton, and Bribie, at Moreton Bay; Fraser or Great Sandy Island, Curtis, Whitsunday, Hinchinbrook, all off the east coast; Prince of Wales, Banks, Thursday, and others in Torres Strait; and the Wel-

lealey Islands, in the Gulf of Carpentaria. Parallel to the east coast, and at no great distance, runs the Great Barrier Reef. A series of parallel ranges of mountains traverses the colony from north to south near the coast, among the numerous local names being Cook Range, Razorback Range, Dawes Range, and Glasshouse Mountains. The Dividing and M'Pherson Ranges run from the head of the Dumaresq River in the south of the colony eastwards to the coast. There is a long range in the interior of the colony running east and west, and forming a watershed between rivers flowing north and those flowing south. The peak of highest elevation is Wooroonooran in a spur of the Coast Range known as the Bellenden Ker Range. Its elevation is 5400 feet. There are four great river-systems: namely (1) rivers draining to the Pacific coast, the chief being the Burnett, the Fitzroy, the Burdekin, and the Brisbane, the last entering Moreton Bay, and having Brisbane, the capital, near its mouth; (2) those draining to the Darling, comprising the Macintyre, the Condamine or Balonne, and the Warrego; (3) those draining to the Gulf of Carpentaria, among them being the Flinders, the Leichhardt, the Albert, the Nicholson, the Gilbert, the Mitchell; (4) those flowing into the interior, the chief being the Victoria or Barcoo, which enters Lake Eyre in South Australia under the name of Cooper's Creek, the Herbert, and the Diamantina or Mueller. The Cretaceous system is extensively developed in the west and north-west of the colony, covering an area of about 200,000 square miles. Tertiary strata occur along the coast of the Gulf of Carpentaria and elsewhere, and occupy a considerable area. The Desert or Eolian Sandstone, which renders extensive tracts barren and almost uninhabitable, is variously classed as Upper Cretaceous or Tertiary. Palaeozoic formations also cover a large part of the country, especially along the eastern coast. About 14,000 square miles are Carboniferous, and some 40,000 of Devonian age, and the Cambrian and Silurian also occur. Mesozoic formations older than the Cretaceous are well developed in some places. Granitic rocks are very extensively developed in the east coast districts, and they have been estimated to occupy about 100,000 square miles. More than 30,000 square miles are covered by volcanic rocks. Gold was discovered about 1858, and there are now more than twenty-five gold-fields in the colony, among them being Gympie (near Brisbane), Charters Towers (on the Burdekin), Cape River, Croydon, Cloncurry, and Jordan Creek. The annual production exceeds £2,500,000. Other minerals of importance are copper, tin, and coal, but antimony, silver, lead, bismuth, manganese, plumbago, asbestos, and precious stones are also obtained. Bluestone, freestone, granite, and other rocks are quarried. Pearl-fishing is extensively carried on in the extreme north, and the béche-de-mer, dugong, and other fisheries are also of some importance. The colony possesses various kinds of valuable timber, such as the red cedar, the Moreton Bay pine, the cypress pine, and several species of eucalyptus, and some of the indigenous grasses are valuable as fodder plants. There are several good indigenous fruits. The climate is healthy, and the temperature comparatively equable, though hot in summer—excessively so in certain districts. The rainfall is great in the coast regions, but much less farther inland. In some parts it is now being supplemented by means of artesian wells, for which there seems to be a great future. Sheep-farming is the chief industry, but cattle do well also. The soil and climate are suited for the production of all the ordinary cereals, as well as maize, tobacco, coffee, sugar,

cotton, and other plants. Maize is more generally cultivated than any other cereal crop. The next crop in point of importance is sugar. All kinds of semi-tropical and English fruits are abundantly grown. The principal manufactures are sugar-mills, steam saw-mills, soap-works, distilleries, breweries, carriage-works, butter-factories, boot and shoe factories, cordial-factories, &c. There are about 2700 miles of railway open. The most important lines are the three which reach the coast at Brisbane, Rockhampton, and Halifax Bay. Education is free and secular in the state schools. A university is to be established for the colony. There is no state church, each religious denomination being entirely self-supporting. The imports come mainly from the United Kingdom and the United States. The most important articles of export are gold, wool, frozen and salt meat, hides, fruit, sugar, copper, tallow, tin, &c. The exports in 1899 were £11,942,858; in 1900, £9,581,560; the imports were £6,764,097 and £7,184,112 respectively. The revenue of the colony exceeds £4,000,000, and the expenditure is usually under it; debt about £34,000,000.

The first settlement of Queensland took place in 1825, when the territory was used as a place of transportation for convicts, who continued to be sent there till 1839. In 1842 the country was opened to free settlers, and in December, 1859, it was organized as a separate colony under its present name instead of the earlier one of Moreton Bay District. In 1901 it became one of the states of the Australian Commonwealth. The government of the colony is vested in a governor, who is the king's representative, an executive council, and a parliament of two houses, the legislative council and the legislative assembly. The council consists of forty-two members appointed by the crown for life, and the assembly of seventy-two members elected by the people for three years, and representing sixty-one electoral districts. Besides the capital of the colony, Brisbane, the other important towns are Ipswich, Rockhampton, Toowoomba, Townsville, Mackay, Maryborough, Gympie, Bundaberg, Charters Towers, Normanton, Cooktown, and Somerset. Pop. in 1881, 213,525; in 1891, 393,718; in 1901, 503,266.

QUEEN'S METAL. See **BRITANNIA METAL**.

QUEEN'S TOBACCO-PIPE, the name popularly given to a furnace in London, formerly situated in the north-east corner of the tobacco warehouses belonging to the London Docks. It was so called because it was used for burning all sorts of contraband articles that had been seized by the custom-house officers, but especially tobacco.

QUEENSTOWN, formerly **COVE OF CORK**, a maritime town of Ireland, and an important naval station, in the county and 9 miles south-west of Cork, on Great Island, which is situated in Cork harbour, and rises abruptly to a considerable elevation. The streets rise above one another, and present a very picturesque appearance. It has a handsome Episcopal church, and a splendid Roman Catholic cathedral. Queenstown is almost solely dependent on the military and naval establishments in its vicinity, and on the numerous visitors attracted by the singular beauty of the place and by its delightful climate. It is an important port of call for mail steamers. In honour of Queen Victoria's visit in 1849 the name of the place was changed to Queenstown. Pop. (1891), 9123.

QUENTIN, Sr., a town in France, in the department of Aisne, on a height above the Somme, 87 miles north-east of Paris. The town is well built, and has among its edifices a beautiful Gothic cathedral; a Gothic town-house, with a tower and

an arcade, formed by eight pillared arches; a court house, theatre, lyceum, public library, infirmary, and several hospitals. The staple manufactures are cotton and woollen goods; and the environs are covered with bleachfields. It is an ancient place, and from its position on the frontiers between France and the Low Countries figures much in history. In 1557 a battle was fought under its walls, in which the French were signally defeated by the Spaniards and a body of English auxiliaries, and the town was afterwards taken and sacked. In 1801 the fortifications were converted into a public walk. In October, 1870, the town was occupied by the Germans, who retained it till the 15th January, 1871, when they were driven out by the French, but only for four days, for it was recovered by them after a battle on the 19th of January. Pop. in 1896, 44,912; in 1901, 50,150.

QUERARD, **JOSEPH MARIE**, a French bibliographer, born at Rennes, December 25, 1791; died at Paris, December 3, 1865. From the age of ten he was connected with the book-trade. In 1817 he came to Paris, and afterwards travelled professionally over France, England, and Italy. From 1819-24 he was attached to a well-known firm in Vienna, and while employed there he prepared the first part of his great work *La France Littéraire*, in which he gives a complete bibliography of France for the eighteenth and the beginning of the nineteenth century, comprising not merely notices of French writers, but also of all those foreign authors whose works had been reprinted or translated in France. The whole work was published in ten volumes between 1827 and 1842. In 1830 the author received from the minister Guizot an annual subvention of 1000 francs to enable him to continue the work. Among the other works of Querard are: *La Littérature Française Contemporaine*, which was intended to complete the former, but of which Querard himself prepared only the first two volumes (1839-44); *Supercheres Littéraires Dévoilées* (1845-56); &c.

QUERCITRON, in dyeing, the internal bark of the *Quercus tinctoria*, a species of oak; it yields its colour, which is yellow, by infusion in water, and by the common mordants gives a permanent dye.

QUERÉTARO, one of the states of the Republic of Mexico; area, 3556 square miles. It forms part of the central plateau of the Cordillera, presenting a very rugged surface, traversed by mountain spurs and lofty heights, sometimes bare and sometimes covered with forests. Its rivers are few, and almost all of insignificant dimensions. The most important vegetable product is grain, which is raised in large quantities, and together with cattle forms the chief wealth of the state. The minerals, once famous, are now comparatively unimportant, though numerous mines are still counted, mostly of silver. Manufactures have made considerable progress, and many woollen and cotton fabrics are produced. Pop. (1895), 224,848; (1900), 228,489.

QUERÉTARO, a city in Mexico, capital of above state, on the railway from Mexico to Leon, at the height of about 6360 feet, 110 miles north-west of Mexico, on the sides and summit of several hills. It consists of the city proper and suburbs, separated by a small stream, and presents an appearance at once imposing and picturesque. Among the public edifices particular notice is due to the principal church, a magnificent and richly-decorated structure, and containing a splendid altar of pure silver; and a noble aqueduct, about 2 miles long, spanning a plain, with arches 90 feet high, and by communicating with a tunnel in the opposite hills, bringing a copious supply of excellent water from a distance of 6 miles. Its manufactures include

woollen and cotton goods, articles in leather, cigars, soap, paper, &c. The peace between Mexico and the United States was ratified here by the Mexican Congress in 1848. Querétaro was the last town in which Maximilian of Austria took refuge, and here he was executed on the 15th of June, 1867. Pop. (1895), 34,576.

QUERN, a hand-mill for grinding corn, such as is or has been in general use among various nations that have not reached an advanced state of civilization, or find such a mill in some respects convenient. The simplest and most primitive form of the quern is that in which a large stone with a cavity in the upper surface is used to contain the corn, which is pounded rather than ground with a small stone. An improved form of the hand-mill is one such as is frequently mentioned in the Bible, and is often described in Jewish and other ancient writers. It consisted of two stones (the upper and the nether millstone) circular in their shape, and with the opposing surfaces carefully cut smooth. The lower stone was fixed on the ground or floor, while the upper was movable, and could be lifted off or turned round as occasion required. A handle of wood or iron was attached to the upper millstone, to enable it to be turned round with greater ease, and a hole was made in the middle of the upper stone to feed the mill, so as to dispense with the necessity of lifting the upper stone off. A farther improvement consisted in cutting the smooth surfaces not horizontal, but with a downward inclination towards the circumference, so as to let the flour run out more easily. Hand-mills or querns of this description are used in Palestine to the present day. Querns are also well known as having long been used in Scotland, Ireland, and other countries. In some of the Scottish islands, if not on the mainland, they are not even yet out of use, and the same is the case with Ireland. A quern described as recently in use in Shetland is represented as being set upon a sort of wooden tray supported against a wall inside a house. The under stone had a hole in the centre through which a wooden spindle passed, so as to serve as a kind of axis round which the upper stone revolved, the upper stone having also a hole in the centre into which the corn was fed. The handle of the quern was a wooden peg fixed in a hole near the margin of the upper stone in an upright position.

QUESALTENANGO. See QUEZALTENANGO.

QUESNAY, FRANÇOIS, a French physician of some eminence, but chiefly noted as a writer on political economy, was born near Versailles on June 4, 1694; and died at Versailles on Dec. 16, 1774. His father was a farmer, and he acquired the rudiments of his profession under a country surgeon; after which, going to the metropolis, he pursued his studies further there. After having passed as a master in surgery he established himself at Mantes, where his success in treating wounds brought him under the notice of Marshal de Noailles, who recommended him to the Queen Marie Leszcinska. In 1731 he accompanied the Duke de Villeroi as surgeon to Paris. Here he was appointed surgeon in ordinary to the king, and in 1737 was appointed secretary to an academy or society that had just been organized for the improvement of surgery. In 1744, having been disabled by repeated attacks of gout from performing surgical operations, he took the degree of M.D., and obtained the situation of physician to Madame de Pompadour, the mistress of Louis XV., and through her interest became physician to the king. Amid the intrigues of a licentious court he observed a simplicity of manners and apparent disinterestedness which formed a strong contrast with the characters of those around him. Towards the latter part of his life he became

the founder of the group of economists known as the Physiocratic School. He was the author of several articles in the *Encyclopédie* (including those entitled *Fermiers*, *Grains*, &c.), in which he expounds his economic views; *Tableau Économique* (1758); *Physiocratie* (1767-68); various works in natural science, medicine, &c. See **PHYSIOCRATIC SYSTEM**.

QUESNEL, PASQUIER (PASCHASIUS), a theologian and moralist, born at Paris on July 14, 1634; died at Amsterdam, December 2, 1719. He became a member of the order of the Fathers of the Oratory in 1657, at that time a great nursery of Jansenism. Almost immediately he set about the composition of a number of devotional works; but the first important work published by him was *Réflexions Morales sur le Nouveau Testament*, consisting of some thoughts on some of the most beautiful maxims of the evangelists. This work rendered him celebrated, but brought him under the suspicion of the church on account of its Jansenistic tendencies. This feeling was increased by an edition of the works of Leo the Great that he published in 1675, and in which he indulged in great freedom of expression. In 1681 he found it advisable to quit Paris, and retired for a time to Orleans. In 1686 he was compelled to seek safety by leaving French territory altogether. He went to Brussels, where Arnould was then residing, and here he applied himself to the continuation of his work on the New Testament, which was published entire in 1693-94. In this some leading points of the papal system were freely questioned. Bossuet and Noailles, archbishop of Paris, rather approved of the book; but the Jesuits laboured to procure a condemnation of it; and having gained the ear of Louis XIV. by his confessor Letellier, obtained through his means, from Pope Clement XI., a bull condemning 101 of Quesnel's propositions as heretical. This bull, the notorious *Unigenitus* (promulgated at Rome, September 8, 1713), not only stirred up the Jansenists, but awoke bitter dissension in the bosom of the Gallican Church, as to the recognition or non-recognition of it, the approvers taking the name of Constitutionists or Acceptants, and the opposers that of Appellants, given to them because they appealed from the pope and his bull to a general council. Meantime Quesnel had been compelled to flee from Belgium (1703), and having escaped to Holland he resided for the rest of his life at Amsterdam.

QUETTA. See SUPPLEMENT.

QUEVEDO-VILLEGAS, DON FRANCISCO DE, a Spanish poet and prose writer, was born at Madrid in 1580, and studied at Alcalá de Henares. Besides the ancient languages his studies comprised theology, medicine, and philosophy, and he combined extensive learning with much wit and great originality. In consequence of a duel he went to Sicily, where his friend, the Duke of Ossuna, was acting as viceroy, being afterwards appointed viceroy of Naples. After having been entrusted with several diplomatic missions, Quevedo returned to Spain, and on account of his connections with the duke, then in disgrace, he was arrested and confined in prison for a time, then sent to his estate, La Torre de Juan, for three years (1620-23). After his liberation he travelled through Spain to restore his health, impaired by his confinement. While living in retirement on his estate, and subsequently, he occupied himself in writing political satires, burlesque poems, and pamphlets, which obtained an extraordinary degree of success. Quevedo having returned to Madrid, the first minister, the Count of Olivarez, resolved to attach him to himself, and offered him several high posts, but Quevedo would only accept the office of secretary to the king (1632). In 1641 (according to others

1639) he exposed himself to the wrath of Olivarez, by causing some stanzas he had composed, depicting the sufferings of the people and the abuses of the government, to fall under the eyes of the king, and for this he was confined till the fall of the ministry in 1643, in a dungeon of the royal convent of St. Mark de Leon. By this second imprisonment his health was completely shattered, and he died about two years after his release, September 8, 1645. His works are various in their character. His humorous productions are distinguished for playfulness, wit, and invention. His prose works are mostly effusions of humour and satire. His Visions (*Sueños*) have been translated into most European languages (English, by L'Estrange); his *Vida del Gran Tacafío* is a comic romance of the sort, called by the Spaniards *picaresco*. He also translated the *Enchiridion* of Epictetus into Spanish. His works have been frequently reprinted.

QUEZALTENANGO, a town of Central America, the second in the state of Guatemala, 90 miles west-north-west of the city of Guatemala, with woollen and other manufactures, and a trade in wool, cotton, &c. It has some handsome buildings, including a cathedral and new municipal buildings. Its port is Champerico on the Pacific, from which a railway runs inland. Pop. 22,000.

QUIBERON, a peninsula on the western coast of France, running south for about 7 miles, and forming part of the department of Morbihan. It contains a small town of the same name, and has on the east the Bay of Quiberon. Here on Nov. 20, 1759, during the Seven Years' War, Admiral Hawke gained a decisive victory over a French fleet under De Conflans. On the 27th of June, 1795, a body of 1200 to 1500 émigrés landed on this coast from a British fleet, and took possession of the peninsula, where they were joined by several thousand royalists and Chouans. The republican forces under Hoche soon cooped them up under the protection of Fort Penhithèvre and the English squadron. But the fort was taken by the republicans, and the royalists, except those who escaped to the British ships, were killed, driven into the sea, or taken prisoners, to be afterwards shot. At Quiberon there is a small harbour, and some sea-bathing is carried on. Pop. 3000.

QUICK (or QUITOH) GRASS. See **COUCH-GRASS**.

QUICK (or QUICKSET) HEDGE, among gardeners, denotes all live hedges, of whatsoever sorts of plants they are composed, to distinguish them from dead hedges, but in a stricter sense the term is restricted to those planted with hawthorn.

QUICKLIME. See **LIME**.

QUICKSILVER. See **MERCURY**.

QUIETISM, a religious movement of the close of the seventeenth and beginning of the eighteenth centuries. Its name is derived from the Latin *quies*, rest, because perfect rest or tranquillity of soul was considered by the adherents of the movement as the great end of life. Those who embraced Quietism were called *Quietists*, and sometimes *Hezychasts*, a term derived from the Greek of the same signification. The ceremonial and hierarchical spirit of some monastic orders, especially of the Jesuits and Dominicans, had in the seventeenth century almost converted religion among the Catholics into a mere mechanical service. The repetition of forms of prayer from the breviary and on the rosary, fasting, confession, frequent pilgrimages, invocations of the mother of God and of saints, almsgiving, the purchase of indulgences, and, in a word, the minute observation of external forms, came to be viewed as real piety. Pious minds, disposed to a more earnest devotion, turned with ardour to mysticism, which afforded

refuge and spiritual aliment to the more feeling soul, when all religion seemed to have become petrified in the forms of ritual observances. The *Spiritual Guide* (*Guida Spirituale*), a work published at Rome in 1675, by Michael Molinos, a Spanish priest, answered this want. With an enthusiasm which soon gained favour to his pious fancies Molinos spoke of the tranquillity of a soul absorbed in the deity, which, dead to all other thoughts and feelings, and disturbed by no outward events, had perception of nothing but the presence of God. In obedience to his instructions the devout now sought solely this tranquillity of soul, and no opposition would have been made to them but for the danger that the devotional exercises enjoined by the church and the monastic orders would appear superfluous. Molinos was obliged to abjure his errors, and terminated his life in daily acts of penance in a Dominican convent in Rome. (He died in 1696.) But this violence by no means prevented the diffusion of Quietism. The *Spiritual Guide* was eagerly studied, and produced a number of similar works in Germany and France, where the way had already been prepared for its reception by the works of Bourignon, Poiréte, and the Pietists. As early as the fourteenth century there was a body of monks called *Hezychasts*, who spent their whole time in prayer and meditation. (See **HEZYCHASTS**.) The most celebrated promoter of Quietism in France was a beautiful and rich widow, a favourite at the court of Louis XIV., Joanna Maria Bouvier de la Motte Guyon, who, under the name of Madame Guyon, is celebrated as an amiable enthusiast of more imagination than judgment. Her example, her prayers, her works, replete with unction, and the exertions of her confessor Lacombe, gained her adherents enough to excite the attention of the clergy. There were, indeed, strong reasons for believing a young woman crazy who imagined herself the pregnant woman of the Apocalypse (xii. 2), and who, in her own account of her life, says that she was often filled with such an overflowing of grace that she was literally on the point of bursting, and that it became necessary to loosen her clothes, upon which this fullness of grace was poured out upon those who did her this service. Lacombe was thrown into prison at Paris, and died in confinement in 1702; but Madame Guyon herself, after a short imprisonment, was restored to liberty, and had the honour of being allowed to take part in the prayers of Madame de Maintenon at St. Cyr. The controversy therefore seemed at an end, when Fénelon thought he discovered in Madame Guyon a kindred spirit, and became the advocate of her and her writings in his *Explication des Maximes des Saints sur la Vie intérieure* (1697). The accession of so distinguished a man, whose works of devotion had been received in France with enthusiasm, gave new weight to Quietism, and an opportunity to Bossuet, the champion of the French theologians, to inflict disgrace on his envied rival. Bossuet obtained, in 1699, a Papal brief which condemned twenty-three positions from Fénelon's book as erroneous; but the humility with which he submitted, and which was admired even in Rome itself, deprived his enemies of the fruits of their victory; and it was the change in the spirit of the times and not violence—though Madame Guyon (who died 1717) underwent another short imprisonment—that gradually buried Quietism in oblivion. It had never formed a sect; but for some years it continued to be the subject of works of devotion and the peculiar opinion of a party among the pious. From Fénelon's book, in which Quietism is most clearly described, we learn that it was a harmless enthusiasm, adapted only to persons of a fanciful and exaggerated turn of thinking. Truth and falsehood are strangely blended in it; it

requires pure love, which, without fear or hope, indifferent to heaven or hell, is directed with entire self-denial to God, merely because he wills it. The flesh must be mortified, every worldly feeling banished, all confidence in our own merits by good works abandoned, and the soul be transferred to a passive state in which its own activity ceases and God alone works in it. This state, which unites the soul essentially with God, is tranquillity, or incessant internal prayer (the permanent direction towards God), in which nothing is desired, nothing asked from God, but, entirely resigned to him, the soul is contented with the pure contemplation of his being. Rarely as these precepts of Quietism can be put in practice, because they comport neither with the wants of human nature nor the demands of our social condition, they have nevertheless frequently reappeared in the mysticisms of later sects. The term has also been applied to the religious notions of the Indian Brahmins, whose object is to attain a state of holiness by the destruction of all corporeal and intellectual activity, and thus to become incorporated with Brahma. See *Madame Guyon's Life* by herself.

QUILLIMANE, a town in Eastern Africa, in the Portuguese territory of Mozambique, about 15 miles above the mouth of a river of the same name (the northern branch of the Zambesi). It occupies an unhealthy marsh; and consists of some substantial brick houses, and numerous huts formed of reeds, and thatched with coarse grass. It carries on a considerable trade in ivory, tortoise-shell, rhinoceros horns, hippopotamus teeth, wax, tobacco, rice, &c. Pop. 3500, or, including the surrounding district, about 15,000.

QUILLOTA, a town in Chili, in the province of Valparaiso, in a beautiful and fertile valley, 23 miles north-east of Valparaiso, which is supplied by it with fruits and vegetables. The copper-mines in the vicinity are regarded as the richest in Chili. The town was founded in 1726, and has since suffered severely on different occasions from earthquakes, particularly in 1826. Pop. 10,000.

QUILLS. The principal use of quills is still for making pens, although they have been so largely superseded by steel and other metals for this purpose. The best quills for pens are those of the swan, but goose-quills are the most commonly used. Crow-quills are used for fine writing and pen-and-ink drawing. In preparing quills for being made into pens the essential process is to cleanse them inside and outside of a fatty matter with which they are impregnated, and which, if not removed, prevents the ink from flowing freely. The Dutch were the first to discover a method of doing this, which consisted in burying the quill ends of the feathers for a few seconds in hot cinders or ashes. Very fine sand at a temperature of about 140° Fahr. is now used instead. After being taken out of the sand-bath the quills are strongly rubbed with a piece of flannel, which makes them white and transparent. A yellow tint is sometimes given to quills by dipping them for a short time in dilute hydrochloric acid, and afterwards drying them thoroughly. (See *PEN*.) Quills, instead of being used whole for pens, are now frequently cut up to make pen-nibs. They are also used for making brushes, artificial flowers, imitative horse-hair work, and a number of other articles, and in particular toothpicks.

QUILTING, a method of sewing two pieces of silk, linen, or stuff on each other, with wool or cotton between them, by working them all over in the form of chequer or diamond work, or in flowers. The same name is also given to the stuff so worked.

QUIMPER, or **QUIMPER-CORENTIN**, a town in France, capital of the department of Finistère, 4 miles

south-east of Brest, at the confluence of the Odet and Steir, and at the head of the estuary into which these small streams flow. It consists of an old and a new town, the former with walls flanked by towers, but very poorly built; and the latter containing a number of good mansions. The principal edifices are a fine Gothic cathedral, built chiefly from the 13th to the 15th century, with a richly-sculptured portal between two massive towers, good stained-glass windows, and mural paintings; the ruins of a Cordelier church and cloister; the lyceum, which formerly belonged to the Jesuits; the prefecture, museum, theatre, &c. The manufactures are earthenware, leather, and cordage; and at the harbour, formed by two quays along the Odet, a large trade is carried on in salt, wines, coal, and manure (which are imported), and grain, flour, earthenware, and fish (exported). The sardine fishery forms an important occupation. Pop. (1896), 15,551.

QUIN, JAMES, an eminent English actor, born in London in 1693, was the son of an Irish barrister, and was educated in Dublin. His father had married a supposed widow, whose husband, after a long absence, returned and claimed her; on which account Quin, who was the offspring of the connection, was deemed illegitimate, and upon his father's death in 1710 was left without a fortune. This interruption of his prospects prevented him from being adequately educated for a profession, and in 1714 he had recourse to the Dublin stage, and in a year after secured an engagement at Drury Lane Theatre. In 1717 he quitted Drury Lane for the theatre in Lincoln's-Inn-Fields, where he remained fourteen years, and gradually acquired celebrity in characters of grave, dignified, and sententious tragedy, as in *Cato*, *Zanga*, and *Coriolanus* (in Thomson's tragedy of that name), and in those of strong, sarcastic, comic humour, as *Falstaff*, *Volpone*, and *Sir John Brute*. In 1732 he removed with the same company to Covent Garden, but in 1735 was induced to join that of Fleetwood at Drury Lane, on such terms as no actor had previously received; and he retained the pre-eminence until the appearance of Garrick in 1741. In 1747 he was engaged at Covent Garden with Garrick; but the new actor obtained so great a share of attention as gradually to induce Quin to retire as a professional actor, although he occasionally performed subsequently for the benefit of his friends. His last performance was *Falstaff* (1753), in which character he is supposed never to have been excelled. He survived his retreat several years, which he spent chiefly at Bath, where his fund of anecdote and pointed sense made him much sought after. Quin, who was convivial and too fond of the bottle, was often coarse and quarrelsome on these occasions, which led to two or three hostile encounters, two of which proved fatal to his antagonist. He was otherwise manly, sensible, and generous; and his deliverance of Thomson, although then unknown to him, from an arrest by a present of £100, is much to his honour. He had an imposing presence, an expressive eye, and a finely-toned and sympathetic voice. He died at Bath on the 21st of January, 1766, aged seventy-three. Garrick, once his rival and afterwards his friend, wrote the epitaph for his monument in Bath Cathedral.

QUINALT, PHILIPPE, the most distinguished of French opera writers, born at Paris in 1685; died there in 1688. Before the twentieth year of his age he brought out some plays, and for several years continued to write with success for the stage. His success, however, only rendered him a mark for the satire of Boileau, who attacked him with so much bitterness as to have injured his own fame. Quinault then abandoned tragedy, which he felt not to be his province, and connecting himself with Lully laboured

for the opera. In this lyric department of poetry he displayed such talents as to be placed above all his competitors, and to be ranked by the best judges among the most distinguished men of the age of Louis XIV. There is nothing in the French language more delicate, tender, and ingenious than the turn of his songs and love dialogues. Boileau and the other censors of Quinault attributed the success of his pieces solely to the merit of Lully's music; which, however, is now forgotten, while Quinault's verse is always read with pleasure. His *Armide* and his *Alys* are master-pieces in their kind. In 1661 Quinault married the widow of a rich merchant, and the fortune that he obtained with her, together with a pension that was granted him a few years later by the king and the sums he received from Lully for his librettos, rendered his circumstances easy. In 1670 he was admitted into the French Academy. Besides his theatrical pieces, he was the author of several occasional poems of little value. His works were published in 1739 and in 1778, in five volumes, with a life prefixed. An edition of his selected works appeared in 1824.

QUINCE (*Cydonia vulgaris*), a low tortuous tree, belonging to the natural order Rosaceæ, named after the ancient town of Cydon, in Crete, from which place it was said to have been introduced into the other parts of Europe; but it appears to grow wild in Western Asia and some of the neighbouring parts of Europe. It is now cultivated throughout Europe and in many parts of the United States for the sake of its fruit, which, though hard and austere when plucked from the tree, becomes excellent when boiled and eaten with sugar, or preserved in syrup, or made into marmalade. Quinces when mixed with other fruit in cookery communicate a pleasant flavour; and a wine may be made from their juice, mixed with sugar in the proportion of one quart to the pound, and fermented. The leaves of the quince-tree are alternate and entire; the flowers are large, white, sometimes with a blush of rose; and the fruit is somewhat pear-shaped, yellowish, and cottony, internally containing five cartilaginous cells, in each of which the seeds are arranged in two series to the number of eight and upwards, and covered with a mucilaginous substance. This character of the numerous seeds is the principal circumstance in its structure which distinguishes the quince from the apple and pear. The rind contains cyanthic ether, to which its peculiar fragrance is due.

QUINCY, the name of two towns and several villages in the United States.—1. A town in Adams county, Illinois, on the left bank of the Mississippi, 105 miles direct, and 170 by the river, north-west of St. Louis. It has various manufacturing establishments, including tobacco manufactories, foundries, machine-shops, saw and flour mills, and an extensive and rapidly increasing trade. Large numbers of hogs are packed here. The haven is one of the best steamboat landings in the Mississippi. Pop. (1890), 31,494.—2. A town in Norfolk county, Massachusetts, on Braintree or Quincy Bay, a branch of Boston harbour, about 7 miles south by east of Boston. It has various manufactures; but the most important and lucrative employment is the working of the quarries, which furnish the well-known Quincy granite, of which some of the finest edifices in the United States are constructed. The fisheries also are important, and a considerable number of vessels are fitted out in the building-yards. Quincy numbers among its natives the two presidents, John Adams and John Quincy Adams, father and son. Pop. (1890), 16,728.

QUINCY, JOSIAH, an American writer born at Boston, February 4, 1772; died July 3, 1864. He was educated for the law, but preferred the sphere of

politics. In 1805 he was returned to Congress in the interests of the Federal party, which during the whole of his career in Congress, extending to 1813, was in a hopeless minority. After his retirement from Congress he was elected a member of the senate of the legislature of Massachusetts, and continued to hold this position till 1821, when he lost his place in the senate, but was returned to the house of representatives, of which he was elected speaker. This post, however, he only retained for one year. From 1829 to 1845 he was President of Harvard College. His principal works are *Memoir of Josiah Quincy, junr., of Massachusetts*; *History of Harvard University*; *Municipal History of the Town and City of Boston during Two Centuries*; *Life of John Quincy Adams*.

QUINET, EDGAR, a French philosopher, poet, historian, and politician, born at Bourg-en-Bresse, in the department of Ain, Feb. 17, 1803; died March 27, 1875. His early studies were classics, modern languages, history, and law; and in connection with these studies he seems to have written a number of juvenile works that were never published. His first published work was a translation of Herder's *Ideen zur Philosophie der Geschichte der Menschheit*, to which he prefixed an introduction (1825). A year or two after the publication of this first work he went to Germany to study philology at the University of Heidelberg, and here he composed two other works of a semi-philosophical nature. In 1828 he accompanied a scientific commission to the Morea, and after his return published *De la Grèce Moderne et de ses Rapports avec L'Antiquité* (1830). During his absence the revolution of July had taken place, and on his return he testified his joy, and expressed his strongly democratic views in a number of political brochures. At the same time he contributed to the *Revue des Deux Mondes* a series of poems and articles of a more purely literary cast, and all distinguished by the excellence of their style (1831-39). During this period he also wrote a remarkable poetical work, *Ahasvérus*, censured by some as cloudy, and by others as also dull, in which he professes to give the history of the world, of God in the world, and finally of doubt in the world. This was finished during a journey he made to Italy in 1832-33, after the death of his father, and was published in the latter year. To the same period belong other two epics, *Napoleon* (1836) and *Prométhée* (1838), in which also he gave expression to his democratic ideas. In 1839 he published in two volumes, under the title of *Allemagne et Italie*, a selection of his contributions to the *Revue des Deux Mondes*. In the same year he was appointed professor of foreign literature at Lyons, where his lectures, which contained the first sketch of his treatise *Du Génie des Religions* (1842), attracted large numbers of hearers. In 1841, in spite of his pronounced republicanism, he received from Villemain, then minister of Louis Philippe, the chair of southern literature in the Collège de France. Here, in concert with his two friends Michelet and Mickiewicz, he made it his mission to inspire his audience with the love of political and religious liberty. He delivered a course of lectures on or rather against the Jesuits, which were received with storms of applause on the one side, and of denunciation on the other. In 1843 the lectures were published under the title of *Les Jesuites*, in the same volume with a number of lectures of Michelet's having the same drift, and this volume excited as much attention as the lectures themselves had done when orally delivered. It passed through numerous editions in French, and was translated into several European languages. The lectures delivered by him in subsequent courses were in a similar strain, and in December, 1846, his class-room was closed by the government, and was not reopened till

after the revolution of 1848. In the events of this revolution Quinet had taken an active part. He was appointed colonel of the 11th legion of the national guard, and soon after was elected a member of the national assembly by the department of Ain, which re-elected him as their representative in the legislative assembly in May, 1849. After the election of Napoleon as president of the French republic Quinet was exiled by the decree of the 9th of January, 1852. His exile, which lasted till after the revolution of 1870 (since he refused to take advantage of the amnesty of the 15th of August, 1858), somewhat embittered his spirit, but ripened his talents, and the numerous works which he produced during this period include some of his best. Among them are the second volume of the *Revolutions d'Italie* (1852), the first volume of which had been published in 1848; *Les Esclaves* (1853); *Marnix de Sainte-Aldegonde* (1854). These appeared during his residence at his first place of exile, Brussels; but in 1858 he removed to Switzerland, where he produced *Merlin l'Enchanteur* (1860); *L'Histoire de la Campagne de 1815* (1862); *La Révolution* (1865); *La Création* (1870). After his return to France he was elected a member of the national assembly, where he took his seat on the extreme left. Two of his last works were *La République* (1872), and *L'Esprit Nouveau* (1874). An edition of his complete works was published in 1877-82 (thirty vols.). See also his *Lettres d'Exil* (four vols. 1884), issued by his widow, and her biography of him (two vols. 1888-89).

QUININE ($C_{20}H_{24}N_2O_6$), a white, crystalline substance, inodorous, very bitter, and possessed of marked anti-febrile properties. It is obtained from the bark of several trees of the order Cinchonaceæ (which see; see also BARK, PERUVIAN). Quinine forms a large series of well-marked salts, the most important of which is the sulphate. *Sulphate of quinine* has the formula $2C_{20}H_{24}N_2O_6 \cdot H_2SO_4$; it crystallizes in scales or in long flexible needles; it is very light, has a bitter taste, and effloresces quickly in the air. The sulphate is largely used in medicine, especially as a tonic and stomachic, and in fever and malarial affections, in neuralgia, &c. In large doses it causes extreme disturbance of the nerves, headache, deafness, blindness, paralysis, but seldom death.

QUINOA. See CHENOPODIUM.

QUINQUAGESIMA, name of the Sunday before Lent, because fifty days before Easter. The name was formerly given also to Pentecost, as falling fifty days after Easter, but in this case it was distinguished as *Quinquagesima paschalis*.

QUINSY, the common name for *cynanchæ tonsillaris* or *tonsillitis*, inflammation of the throat. The name has gradually been corrupted through the French, from the Greek and Latin *cynanchê* or *kynanchê*. The oldest form in which it appears in English is *sqinancy*; it then becomes *sqinzey*, and finally *quinsy*. The inflammation is generally ushered in by a feeling of uneasiness in the part. The voice is husky and altered in tone; the pain gradually becomes very severe, shooting along the course of the Eustachian tube towards the ear. There is often swelling of the glands of the neck, and for the most part loss of appetite, thirst, headache, and a considerable degree of general fever. On looking into the back part of the mouth, the tonsils, uvula, and even the soft palate are seen to be swollen and vascular. The tongue is generally foul and furred. In severe cases respiration is considerably impeded, and swallowing is always difficult and painful, so much so that in some cases only fluid aliments can be taken by the patient. The inflammation of the throat may terminate either in resolution or suppuration. When the latter is the case the patient's sufferings are

generally aggravated, and the difficulty of breathing and swallowing increased; but when the matter produced by the suppuration is discharged almost immediate relief and rapid recovery follow. The most frequent cause of this affection is cold, produced by sudden vicissitudes of weather, or sudden changes of temperature, as by persons suddenly coming out of a heated room into a cold night atmosphere. But in a great many cases it will be found that the patient has been predisposed to the disease, owing to his digestive organs being in a bad state previously; and persons who have long been subject to this complaint on the slightest exposure to cold have succeeded by attention to the state of their stomach and bowels in keeping free of the disease.

This disease is one difficult to manage, unless the patient be seen at the commencement; and even then in persons subject to the complaint it will often run its course in spite of the most active treatment. In most cases, however, if prompt measures are taken an attack may be arrested, or at least mitigated. The best treatment for this purpose is to administer a dose of some strong purgative, and to follow that almost immediately with an emetic. Sinapisms or light stimulating liniments should be applied to the throat during the course of the disease, and flannel should constantly be worn round the neck. Gargles are sometimes used, but the gargling is apt to produce irritation, and the best local remedy is the inhalation of the steam of warm water. The best method of doing this is to fill a basin or bowl with warm water, or vinegar and water, to place it on the centre of a towel, and to gather up the ends of the towel round the face, and to keep the mouth open so as to allow the steam to ascend into it. The bowels should be kept gently open, and a degree of perspiration kept up until the disease begins to give way; and the diet should be light, consisting of arrow-root, sago, or Iceland moss, with plenty of diluent drinks.

QUINTAIN, an apparatus used in a military sport or exercise by men on horseback, formerly practised in England to try the agility of the country youth. The quintain was an upright post with a cross-bar on the top of it, turning round on a pivot. To one end of the bar was suspended a bag of sand, the other end was broad and flat. The horseman had to ride tilt at the flat end with his lance, and endeavour to strike it and pass on before the bag of sand could whirl round and strike him on the back.

QUINTAL, an old French weight, equal to 100 livres, or 108 lbs. avoirdupois very nearly. The *quintal métrique* is 100 kilogrammes, or 220 lbs. avoirdupois.

QUINTANA, MANUEL JOSÉ, one of the most celebrated of modern Spanish poets, born at Madrid in 1772, studied at Cordova and Salamanca, and then took up his residence in the college of advocates. Here he filled in succession the offices of fiscal agent to the junta of trade, theatrical censor, general secretary to the central junta, acting secretary to the king, and secretary to the department for the interpretation of foreign tongues. At the time of the first ruling cortes he was elected member of the supreme censor junta. Almost all the proclamations and manifestoes in the war of independence were composed by him, and he also wrote a series of patriotic poems, entitled *Odas a España Libre* (1808). He edited the journal *Variedades de Ciencias, Literatura, y Artes*, and founded the *Semanario Patriótico*, which vigorously attacked the ascendancy of Bonaparte. After the restoration he was confined in a fortress, and first obtained his freedom in 1820, when he was replaced in his former offices, and also named president of the newly-formed general directorship of studies. In 1823, however, he was again deprived

of all public employment, and lived retired on his property in the country till 1828, when permission was given him to return to Madrid. Another political change in 1833 brought him once more on the stage of public life, and he was named member of the council of state. After the erection of the first chamber he was elected a senator, was repeatedly secretary to the chamber, became also tutor to the queen, and was named president of the council of studies. He is one of the few writers of modern Spain who has earned for himself a European fame, his poetical, critical, and historical works being held in the highest estimation, not only in Spain, but also in foreign countries. His first lyric ode, published in 1795, and entitled *Oda a Mar*, attracted general attention. His poems are distinguished by the selection of subjects bearing directly on the interests of humanity and of his country, by a philosophical tendency, a patriotic spirit, and a vigorous manly style. As a historian, or rather biographer, he has made himself well known by his *Vidas de Españoles Celebres*, which holds a place in the front rank of classical Spanish prose. His complete works form the nineteenth volume of the *Biblioteca de autores españoles* (Madrid, 1852).

QUINTESSENCE (from *quinta essentia*, the fifth essence, by which the Pythagoreans meant the æther), in chemistry, the concentrated extract of the virtues of a substance; hence, in general, the purest, best, or highest state of a quality.

QUINTET, or **QUINETT** (Italian, *quintetto*), a vocal or instrumental composition in five parts, in which each part is obligato, and performed by a single voice or instrument.

QUINTILIANUS, **MARCUS FABIUS**, a Roman rhetorician, born at Calagurris (Calahorra) in Spain, probably between 35 and 40 A.D.; died, it is supposed, about 118. At an early age he was brought to Rome, where he attended the lectures of Domitius Afer. He afterwards revisited Spain, and on coming to Rome a second time (about A.D. 69) began to practise as an advocate, and subsequently became a teacher of rhetoric. Some of the most eminent Romans were his pupils, and the Emperor Domitian bestowed on him the consular dignity. During the reign of that emperor Quintilian wrote his excellent work, *De Institutione Oratoria*, which contains a system of rhetoric in twelve books; it exhibits him as a practised master, a man of taste and talents, and a worthy imitator of Cicero. The tenth book, which contains his opinions of Greek and Roman writers, is particularly interesting and important for the history of literature, and is characterized no less by acuteness than cogency of reasoning. There are also a considerable number of rhetorical speeches (*declamationes*) attributed to him, but they are not considered genuine. A treatise, *De Oratoribus sive de Causis corruptæ Eloquentiæ*, is often published with his works, but is also ascribed to Tacitus and to other writers. The best editions of Quintilian are those of Burmann (Leyden, 1720, two vols. 4to), Capperonier (Paris, 1725, fol.), Gesner (Göttingen, 1738, two vols. 4to), Spalding and Zumpt (Leipzig, 1798–1829, five vols.), and Halm (1868–69). There are also special editions of the tenth book, among which are those of Bonnell (Leipzig, 1851), Krüger (Leipzig, 3rd ed. 1888), and Peterson (Oxford, 1891).

QUINTUPLE ALLIANCE. See **QUADRUPLE ALLIANCE**.

QUINTUS CALABER, or **SMYRNÆUS**, a Greek poet, the time and place of whose birth are uncertain. His surnames are derived from the discovery of his poem in Calabria (in a convent at Otranto), and his mention of Smyrna as the place of his residence. He probably flourished in the fourth century A.D. His

poem, *Paraleipomena Homērō* (Supplement to Homer), is a continuation of the *Iliad*, in which Homer is indeed imitated, but by no means equalled in grace and simplicity. A critical edition of this work, by Tychsen, with remarks by Heyne (Strasburg, 1807), was published at the expense of the Bipont Society. Köchly's edition (Leipzig, 1853) is the latest.

QUINTUS CURTIUS. See **CURTIUS**.

QUIRE (French, *cahier*), twenty-four sheets of paper. Twenty quires make a *ream*.

QUIRINUS, among the Romans, a surname of Romulus after he had been raised to the rank of a divinity; and at a later period of Mars and Janus, sometimes also of Augustus (in Virgil's *Georgics*, iii. 27). It is supposed to have been derived from the Sabine word *quiris* or *curis*, which is said to have signified a spear, and figuratively a soldier. The terms *Quirinalis*, a festival in honour of Romulus, held annually on the 13th day before the Kalends of March, according to the Roman way of counting, that is, the 17th of February; and *Quirinalis*, one of the seven hills of Rome, are of the same origin. The hill is supposed to have obtained its name from the fact that a temple was erected on it dedicated to Quirinus.

QUIRITES, originally the inhabitants of Cures, one of the principal of the Sabine towns, and hence the name of that portion of the Sabines who at an early period joined with the Romans. After this union the name was assumed along with that of *Romani* as a general appellation of the two peoples, but *Quirites* came to be applied to them in their civil capacity, while *Romani* was applied to them in their political and military capacity. On this account it was regarded by the soldiers as a great indignity to be addressed as *Quirites*, and Julius Caesar is said on one occasion to have quelled a rising mutiny among his troops merely by using this word in the speech in which he harangued them.

QUI TAM ACTIONS, in English law, popular actions on penal statutes, partly at the suit of the crown and partly at that of an informer. They are so called from the words '*Qui tam pro domino rege quam pro se ipso sequitur*' (Who sues both on behalf of the king and on his own behalf).—(Wharton's *Law Lexicon*.)

QUIT-CLAIM, in law, signifies a release of any action that one person has against another. It signifies also a quitting of a claim or title to lands, &c.

QUITO, the capital of Ecuador, in a ravine on the east side of the volcano of Pichincha, 9540 feet above the level of the sea, 170 miles N.N.E. of Guayaquil, a little to the south of the equator. Its streets, with exception of four which meet in the large central square, are narrow, uneven, and dirty; and the houses, built for the most part with sun-dried bricks, and thatched with the leaves of the magney or American aloe (*Agave Americana*), possess no architectural merit. The more important public buildings and establishments are the cathedral, many other churches and convents; the capitol, or building in which the legislature meets, the town-house, court-house, president's palace, archbishop's palace, university occupying part of the extensive and handsome buildings of the old Jesuit college, museum, observatory, public library, orphan asylum, general prison, and hospital. The manufactures consist chiefly of woollen and cotton goods, which, though coarse, are substantial and in considerable demand; lace, hosiery, confectionery. The trade is much restricted owing to the want of good roads and railways. Even with Guayaquil, the chief port of Ecuador, the communication is defective, though a railway, leaving this port, partly covers the distance, and is intended to be completed to the capital. Part of the trade with

Guayaquil is by way of the river Guayaquil and the river port Babahoya. Before the arrival of the Spaniards in South America Quito was the capital of a kingdom of the same name, which was conquered by Huayna-Capac, the twelfth inca of Peru. It was taken by the Spaniards in 1534, and incorporated as a city by Charles V. in 1541. It remained with Peru till 1718, when it fell to New Granada. In 1819 it became one of the towns of the Republic of Colombia, and in 1831 of Ecuador. It has repeatedly suffered much from earthquakes. In that of 1797 40,000 persons are estimated to have perished. Pop. estimated in 1891 at 50,000.

QUIT-RENT, in law, a small rent payable by the tenants of most manors, whereby the tenant goes quit and free from all other services. Anciently this payment was called white-rent, because it was paid in silver coin, and to distinguish it from rent-corn.

QUOIN (French, *coin*, Latin, *cuneus*, a wedge), a technical word for a wedge; in artillery, the wedge used to elevate and depress a cannon or other piece of ordnance; in printing, the wedges used to fix pages of type within the chase. In architecture the term is applied to any external angle, but especially to the angular courses of stone projecting beyond the plane surface of the wall at the corner of a building, and specifically designated rustic quoins.

QUOITS, a game somewhat resembling the throwing of the discus among the ancients; only the discus was flat, while the quoit is ring-shaped. (See DISCUS.) The quoits are made of metal, usually iron, and are

comparatively thick at the inner edge of the ring, but sharp enough at the outer edge to stick in soft clay when properly thrown. In size they vary from 8 to 9½ inches. The game is played on a ground from 18 to 24 yards in length, at each end of which a pin called a hob is fixed in the ground to serve for a mark. The object of the game is to throw the quoits from one end of the ground to the other so as to make them stick in the ground as near the hob as possible. The best shot, called a ringer, is when the quoit surrounds the hob. The players are divided into sides, and each player has two quoits, which he delivers in succession. The winning side counts one for each quoit that it has nearer the hob than the nearest of the losing side, and if it has a ringer it counts two for it. The rules as to the size of the quoit, the distance between the hobs, and other particulars, vary with different clubs.

QUORUM, a term used in commissions, of which the origin is the Latin expression, *quorum unum A. B. esse volumus* (of whom A. B. shall be one), signifying originally certain individuals, among several persons invested with power, without whom the others could not proceed in the business. Thus among the justices of the peace it was customary to name some eminent for knowledge and prudence to be of the quorum; but all justices are now generally of the quorum. In legislative and similar assemblies a quorum is such a number of members as is competent to transact business.

QUO WARRANTO. See QUEEN'S BENCH.

R.

R, the eighteenth letter of the English alphabet, called by grammarians a liquid. (See L.) This letter is pronounced in various languages, and in several instances even in the same language, in different ways. The most natural mode, at least that which is most agreeable to the ear, and most common in the various languages, is by an expiration, whilst the tongue touches the roof of the mouth with a tremulous motion,—the pronunciation of the English *r* at the beginning of a syllable, as *rhetoric*. This tremulous motion of the tongue makes the pronunciation of *r* more difficult than that of any other letter in the alphabet, so that it is the last which children learn; and if the tongue is too thick, or is too closely joined to the lower part of the mouth, they do not learn it at all. Indeed, the sound of *r* is entirely wanting in some languages, as in Chinese and the languages of some Indian tribes. (See L.) Another pronunciation of the letter *r* is produced by applying the uvula to the posterior part of the tongue and causing it to vibrate distinctly. This is what constitutes the Northumberland burr, the *ghr* sound in Arabic, and the *r grasseyé* of the people of Provence and the Parisians. By the English the letter *r* is distinctly pronounced only when it begins a word or syllable, and not always then. After most vowels it is heard when pronounced by them only as a slight impediment to the emission of the breath in consequence of the tip of the tongue being brought near the roof of the mouth, but not allowed to touch it, and after the vowel *a* in such words as *far*, *farther*, &c., and *o* in *corn*, it is scarcely heard at all. The tremulous motion of this letter produces, in speaking quickly, an uncertainty as to its preceding or following the vowel, so that *r* is transposed oftener than any

other letter: to burn is in Anglo-Saxon *brinnan* or *byrnan*, in German it is *brennen*; the Scotch *burn*, a stream, is in Icelandic and Swedish *brunn*; the English *horse* corresponds to Icelandic *hross*, and to Old High German *hros*. As the pronunciation of *r* differs from that of *l* only by the tremulous motion of the tongue, it is natural that either of them should often take the place of the other. (For some remarks respecting both letters see the letter L.) The pronunciation of the letter *s* is also much allied to that of *r*, as the tongue is in the same position, only allowing the air to pass over the point instead of shaking it. Hence also the frequent alternation of these two letters; as, in Latin, *arena*, with the ancient Romans *asena*; *ara*, anciently *asa*; *plurima*, anciently *plusima*; *honor* and *honor*, *arbor* and *arbor*; *hare*, in German *Haas*; *war*, in German *war*; the German *Rohr*, in Ulphilas *Raus*, and in French *roseau*, &c. The Æolic dialect in Greek substituted *r* for a final *s*, as *houtor* for *houlos*, *hippor* for *hippos*, *martur* for *martus*. The R of the Romans was derived from the P (*rho*) of the Greeks. It is the *resh* of the Phœnicians and Samaritans, formed thus, ρ and פ.—As a Roman numeral it signified 80, according to the verse,

Octoginta dabit tibi R, si quis numerabit;

with a dash over it, 80,000. With the Greeks, *ρ* with the accent over it signified 100; with the same sign under it it was 100,000. The Hebrew *resh* (ר) denoted 200, and (ר) 200,000. R on ancient medals signifies *Ravenna*, *reduz*, *regia*, *restitutor*, *Roma*, *Romanus*, &c.; P. R., *populus Romanus*; R. P., *res publica*; R. C., *rescriptum*, &c. R, in numismatic works, signifies *rare*, and the different degrees of rarity are indicated by one, two, three, &c. It was

the mark of coins struck at Orléans, and previously of those which proceeded from the mint of Ville-neuve-les-Avignon. R stands, in modern times, for *rex* or *regina*.

RAAB, Hungarian GYOR, a town in Hungary, capital of the county of the same name, at the confluence of the Raab and Rábnitz with the Danube, 67 miles w.n.w. Buda. It stands in a beautiful plain, almost surrounded by three rivers, and is thus advantageously situated both for defence and commerce. It is the see of a Roman Catholic bishop, and has an episcopal palace, diocesan seminary, two monasteries, a royal academy, gymnasium, and several other schools. Its manufactures are woollen cloth, cutlery, including swords, and tobacco; and there is a considerable trade. Raab was a place of some importance under the Romans, and makes a figure both in the early wars of Hungary and those of still more modern times. On the 14th of June, 1809, the Archduke John of Austria and the Palatine of Hungary were defeated here by the French under Eugène Beauharnais. A great many Roman coins have been found here. Pop. (1890), 23,958; (1900), 28,989.

RAALTE, a town in Holland, one of the prettiest in the province of Overijssel, 9 miles south-east of Zwolle; with a weekly cattle and annual horse markets. Pop. 5795.

RAASAY, or **RASAY**, an island in Scotland, one of the inner Hebrides, in the county of Inverness, between Skye and the mainland, about 13 miles long north to south, and 2 miles broad at the widest part. It may be considered as forming a single ridge of unequal height, in its southern or highest end averaging 1000 feet, culminating on the flat-topped eminence of Dun Can, 1500 feet, on the south-east coast. The west side of the island is sufficiently uninteresting; on the east it is otherwise; here are numerous scattered farms, each surrounded with its cultivated tract; and the whole diversified by towering rocks, formidable cliffs, and patches of brushwood. On a lofty cliff, beetling over the sea, in the northern part of the east coast, stands the picturesque-looking castle of Brochel. Freestone of the finest quality abounds in this island, as does also limestone and a valuable kind of granite. The herring fishing was at one time carried on here to a great extent, particularly in the Sound of Raasay, the narrow channel which separates the island longitudinally from Skye. Pop. (1891), 438.

RABAT, a maritime town in Morocco, in the province of Fez, on the Atlantic, at the mouth of the Buregreb, and opposite Salée, 62 miles west of Mequinez. It is surrounded with a wall flanked by numerous towers, and has a citadel and batteries. The streets are steep and inconvenient, but the houses generally have a respectable appearance, and some of them are well built. It has some manufactures (carpets, woollens, cottons, and leather) and considerable trade. Formerly the ships of the pirates of Salée were built on the ships belonging to this place, but now the only vessels constructed here are a kind of skiffs of little draught used to convey passengers and merchandise across the dangerous bar at the mouth of the Buregreb. In November, 1851, it was bombarded by a French squadron, under Rear-admiral Dubourdieu. Pop. 30,000, including a considerable proportion of Jews.

RABBI, a title of honour among the Hebrews, derived from a root signifying 'much' or 'great,' and hence corresponding to the Latin *magister* (English, *master*), from the root *mag*, having the same meaning. John expressly states that the word was equivalent to 'teacher' (Greek, *didaskalos*, rendered in the Authorized Version 'master'; John i. 38). There are two other forms of the title, *rabboni* and *rabbani*, the first of which is found in the New Tes-

tament. All of these are also found without the final syllable (*rab*, *rabbon*, *rabbani*), and the *i* at the end may either be regarded as a lengthening of the words without any particular meaning, or as the pronominal affix meaning 'my,' but in any case it came practically to be an essential part of the title. The form *rabbani* was considered the most honourable, and was only applied to seven persons. *Rabbi* was also looked upon as a higher title than *rab*. It is supposed that this title first came into use at the period immediately preceding the birth of Christ. In the time of our Lord it was applied generally to all religious teachers, and hence sometimes to Christ himself. Now the term *rabbi* is applied to regularly appointed teachers of Talmudic Judaism. Since 1831 these have in France been salaried by the state. Their duties are not only to give instruction in the Talmud, but also to draw up deeds of marriage and divorce, to examine butchers, and to give their opinion as to what is legal and what is illegal in the Jewish ritual.

The name of Rabbinical language is frequently given to that form of Hebrew in which the Jewish scholars and theologians of the middle ages composed their works. Grammatically it differs but little from the ancient Hebrew, although there are a few Aramaic forms. But the vocabulary is necessarily considerably different, since words had to be found for many objects and ideas that are not mentioned in the Scriptures. To meet this want the rabbinical writers in many cases attached new meanings to Hebrew words already in use, in other cases made new derivatives according to the grammatical laws of the language from old Hebrew roots, and finally borrowed from the Arabic many words that had already acquired a technical sense in that language. For the acquisition of this language there have been grammars and lexicons, &c., prepared by Cellarius, Reland, Hardt, Tychsen, Buxtorf (*Lexicon Chaldaicum, Talmudicum et Rabbinicum*; Basel, 1639; new edition by Fischer, Leipzig, 1866, fg.), and others, and the labour of the study is repaid by the richness of the rabbinical literature, which may be learned particularly from the works of Buxtorf, Bartoloccius, and Wolf. Among the authors during the most flourishing period of the middle ages Aben Ezra, David Kimchi (who died about 1240), but especially Elias Levita, are celebrated as grammarians. David Kimchi was also the author of a Hebrew lexicon, which long retained a classical reputation. Of later scholars the principal are Meyer Hallei (Haramah) of Toledo, in the beginning of the thirteenth century; Menachem de Lonzano and Solomon Norzi, whose labours surpass those of all the preceding in extent and thoroughness. Among the commentators on the Old Testament the most conspicuous are Aben Ezra, a learned philologist, but obscure writer; Solomon Jarchi, a poor linguist, and also obscure writer (died about 1180); Joseph Kimchi (flourished about 1160), one of the most learned of the Jews, and his son David Kimchi, already mentioned as a grammarian, Maimonides, Levi Ben Gerson (before 1370), and Isaac Arbarbanel (before 1508). Maimonides endeavoured to aid the interpretation of the holy writings of his nation by philosophical-theological disquisitions; among the many commentators, he and Raschi were the most distinguished. The above-mentioned Levi Ben Gerson and Lipman of Mühlhausen (1399) wrote in defence of their faith. In respect to the geography of the middle ages Moses Petachia of Ratisbon (before 1187), Benjamin of Tudela (died about 1173), and Perizol of Avignon (about 1550), rendered much service by the descriptions of their travels. Mathematics, likewise astronomy, philosophy, and medi-

one, were studied with great avidity by the Jews, especially in the schools of the Arabs in Spain; but as few of their scientific works are printed, we must be satisfied with referring to the oft-named Maimonides, who, as a philosopher, mingled the notions of Aristotle and Plato with the Cabala and the Talmud, but who, in his medical works (Aphorismi, and De Regimine Sanitatis), showed himself a follower of Galen.

RABBIT (*Lepus cuniculus*), a genus of Rodent Mammals, included in the family Leporidae, to which group also belong the Hares (which see) and Calling Hares or Pikas (*Lagomys*). This family is distinguished by its members possessing two small incisors in the upper jaw in addition to the two ordinary incisors, thus making four incisors in the upper and two in the lower jaw, whilst no canines exist in either jaw. The premolars number six in the upper and four in the lower jaw, and the molars exist to the number of six in each jaw. The latter two kinds of teeth are destitute of roots, and the clavicles or collar-bones are of rudimentary nature. The front feet possess five and the hinder have only four toes, whilst the hind legs exceed the fore limbs in length. The tail is short and erect, and the two orbits or eye cavities of the skull communicate by an aperture in the septum or partition which divides them. The Common Rabbit differs from the Hare by its generally smaller size, by the shorter ears of uniform brown colour, and by the shorter limbs. The Hare possesses a redder fur, and greater relative length of ears, which are tipped with black. The hind legs in the Hare are proportionally longer than in the Rabbits, and the eyes are larger and more prominent than in the latter animal. Another difference between the rabbit and the hare is that the rabbit digs burrows in the ground in which to shelter itself, while the hare never does so. The rabbit's fur in its native state is of a nearly uniform brown colour, whilst under domestication the colour may become pure white, pure black, piebald, gray, and other hues. The texture of the fur also changes under domestication. The rabbit prefers to live in the immediate vicinity of its fellows, and large numbers of them often have their burrows in some dry sandy bank overgrown with furze or brush, or other similar locality. Such 'warrens' are often specially set apart for them in order that they may breed and multiply for the market, their flesh being excellent as food, and their fur and skins of value. The burrows which these forms excavate are irregularly disposed, and communicate freely with each other. They are extremely prolific, and begin to breed when about six months old. They may breed six or seven times a year, producing from five to seven or eight at a birth. The parturient rabbit appears to excavate a special burrow or tunnel for herself in which to give birth to and shelter her progeny, the nest being lined by down plucked from her own body. The young are hairless when born, and have their eyes closed. The eyes open about the tenth or twelfth day. These animals feed on tender grass and herbage, and sometimes do great damage to young trees by stripping them of their bark—a process in which they are greatly assisted by their sharp, chisel-like, incisor teeth. The rabbit seems to have no liking or social feeling for the nearly-allied hare, and it only rarely happens that a hybrid progeny of the two species is produced. In such cases, with one or two exceptions, the father of the hybrids has invariably been a rabbit and the mother a hare. These animals grow exceedingly tame and domesticated, and may exhibit no small degree of intelligence. Their flesh is forbidden to be eaten by the laws both of Moses and Mohammed. They are snared, taken by ferrets and nets, or may be shot. Rabbits are subject to certain diseases, such

VOL. XI.

as rot, parasitic worms, and a kind of madness. The original home of the rabbit is believed to be Spain and other countries around the western half of the Mediterranean, but it is now widely spread, having been conveyed by man to such distant lands as the Australian colonies, Tierra del Fuego, and the Falkland Islands. In Australia and New Zealand it has multiplied so enormously as to have become quite a pest to the colonists, causing immense loss and damage by eating up the pasture intended for sheep and cattle. Various methods of extermination have been tried against them, but as yet none have had more than a moderate success. They are now killed and exported as food, frozen or otherwise preserved.

RABELAIS, FRANÇOIS, a humorous and satirical French writer, author of *Gargantua and Pantagruel*, was born at Chinon, in Touraine, about 1495 (or according to others, but apparently less probably, about 1483). He was the son of an apothecary, or according to some of an innkeeper. Rabelais, by the desire of his father, entered the Franciscan order at Fontenay-le-Comte, in Poitou, where he received the priesthood about 1511; but the absence of all true learning soon disgusted him with this residence, and his satirical humour, and some youthful indiscretions, no less than his addiction to profane studies, drew upon him the hatred of the monks. He was about to be proceeded against by the superior of the monastery, when he made his escape. Shortly after, through the influence of powerful friends, he obtained the permission of Clement VII. to enter the Benedictine order (about 1523); but in no long time he quitted this brotherhood also, and began to traverse the country under the habit of a secular priest. His biographers have found it difficult to follow him during this period of his life, but it seems that in his wanderings he cultivated all the sciences of the day, and especially philology, with assiduity, and that in this he exhibited powers of acquisition such as few have possessed before or since. In 1530 he was enrolled as bachelor in the faculty of medicine at Montpellier, and from 1531 he practised as a physician with success, although it was not till May 22, 1537, that he obtained the degree of doctor. In 1532 he went to Lyons, where he published editions of *Hippocrates* and *Galen*, remarkable for their accuracy, and the first germ of his *Gargantua* (1532 or 1533), of which, according to his own account, more copies were sold in two months than of the Bible in nine years. This first specimen of the power of Rabelais in the style that has rendered him famous has all the grotesque humour, amounting even to buffoonery, and the variety of marvellous adventures of his later works of the kind, but wants the delicate raillery, the sustained allegory, and profound philosophy, which most students of Rabelais find in the subsequent versions of *Gargantua*, and still more in the three last books of *Pantagruel*. The first part of *Pantagruel* appeared under the anagrammatic pseudonym of Alcofrilas Nasier, within a year or so after the first work, bearing the name of *Gargantua*, and its success was such that it passed through three editions in one year. Soon after its publication he accompanied, probably as physician, Jean du Bellay, on an embassy to Rome, where he remained six months. On his return to France he went first to Paris, summoned there, it is said, by King Francis himself; but not long after he is found again at Lyons, where the *Gargantua*, as we now have it, first saw the light in 1535. In 1536 he was again at Rome, and on this occasion he obtained from the pope absolution for the violation of his monastic vows, and permission to hold benefices. It was in virtue of this permission that he was enabled to enjoy a prebend granted to him by Jean du Bellay in the abbey of Saint Maur.

des-Fossés. It was on his return from this second visit to Rome that he took the degree of doctor at Montpellier, at the date already mentioned. In the year following he is known to have been practising his art at Paris, but his love of wandering had not yet ceased, and his place of abode for the next eight or nine years was as unsettled as it had been during any previous part of his life. In 1546 he was probably in Paris, when the third book of his *Pantagruel* appeared. In this book the fantastical and trivial adventures that crowd the previous ones give place in a great measure to regular dissertations, in which all the great moral and social questions of the day are discussed with the gaiety and irony peculiar to Rabelais, and with a freedom that roused the suspicion of the clergy, who endeavoured to have it suppressed. The favour of the king secured the free publication of this book, but it was with more difficulty that a license was obtained for the fourth book from the next king (Henry II.), who had succeeded Francis in 1547. A mutilated edition of this book appeared surreptitiously at Lyons in 1547. The license to publish was not obtained till 1550, and it was only in 1552 that a complete and authentic edition of the book appeared. On the 8th of January, 1551 (1550, according to the mode of reckoning of the time), Rabelais was installed in the cure of Meudon, which he had had bestowed on him by his former patron Jean du Bellay, and here he seems chiefly to have resided during the remainder of his life. He is said by good authorities to have died at Paris, April 9, 1553; but Antoine le Roy, one of the successors of Rabelais in the cure of Meudon, and therefore one who may be supposed to have had access to documents referring to Rabelais now lost, places his death as late as 1559. He left at his death the whole of the fifth book of *Pantagruel* in manuscript. A sixth book was intended to be added, but there is only a fragment of it indicating its subject, *Les Noces de Panurge*. Rabelais was one of the first to give flexibility and finish to the yet rude and harsh language of his country. Boileau calls him *la raison en masque*, and Rousseau, *le gentil maître François*. He was a conscientious teacher of his people, and it was his pleasure to instruct the children of his parish in sacred music. His house was the resort of the learned; his purse was always open to the needy; and his medical skill was employed in the service of his parish. His work cannot now be easily understood without a glossary and commentary. Among the best editions of the *Gargantua and Pantagruel* may be mentioned that of Le Duchat (Amsterdam, 1711); the Variorum edition (Paris, 1823-26); a splendid edition, illustrated by Gustave Doré (Paris, 1858); a one-volume edition by Louis Barré (1864). Four volumes of a fine edition of his complete works, with notes and a glossary by Marty-Laveaux, appeared at Paris in 1870-81. There are English translations by Urquhart and Motteux (1653-94; new ed. 1892) and W. F. Smith (1893).

RABIES, the name given to a disease with which dogs, horses, cats, wolves, and other animals are attacked, and to which, indeed, all animals are said to be liable. A bite from some rabid animals induces hydrophobia in man. See the article **HYDROPHOBIA**.

RABUTIN. See **BUSSY-RABUTIN**.

RACCOON. See **RACON**.

RACEME, in botany, a form of inflorescence in which the primary axis is elongated, and bears flowers placed on pedicels of nearly equal length. The inflorescence is centripetal or indefinite. A raceme differs from a spike only in the flowers being stalked, instead of being sessile. Examples occur in the currant, laburnum, barberry, &c.

RACHEL, **MADemoisELLE**, a celebrated French

tragédienne, was born at Munf, a village of the canton of Argovia, in 1821, of Jewish parents, and from her earliest years was accustomed to the endurance of great hardship and penury. Her proper name was *Elisa Felix*. Her original occupation was singing in the streets of Lyons with her sister Sophia, who went by the name of Sarah. Having attracted the notice of M. Choron, director of the Conservatoire of Sacred Music, she was placed at first in his own institution; but when she lost her voice, as she did soon after, was through his recommendation placed under the charge of M. St. Aulaire, a professor of elocution. At first she gave few indications of the powers which she afterwards displayed; but was taken in hand by the celebrated M. Samson, and after a course of instruction at the Conservatoire made her *début* in 1837, at the age of sixteen, on the stage of the Gymnase. She attracted no special attention here; but having been transferred in June of the following year to the boards of the Théâtre Français, took the Parisian public by storm by the admirable manner in which she impersonated the classic creations of Racine and Corneille. Her reputation was speedily established as the first tragic actress of her day; and by 1841 she was in the receipt of a salary of 60,000 francs, or £2400, with three months' leave of absence. The same year she visited England for the first time, and was received with the greatest enthusiasm. Her renown continued to increase, and for many years she reigned supreme at the Théâtre Français, making also excursions to the provincial towns of France, to Belgium, and other places, from which she reaped golden harvests. Latterly she crossed the Atlantic to America, but when there caught a severe cold, which terminated in a consumption. After struggling with the disease for some time, and visiting different localities in search of health, she expired at Caunet, on the shores of Provence, on the 3d of January, 1858. In recording the history of Rachel it is painful to reflect that so much vigour and splendour of genius should have been united with a character singularly devoid both of moral principle and womanly virtues. A grasping and avaricious spirit, restrained by no feelings of honour or propriety, and combined with a fierce and unloving temper, forms a prominent feature in the portrait of Madlle. Rachel. It must be added also that her moral deportment was far from correct, as was unequivocally established by the fact of her being the mother of several natural children. One redeeming point, however, ought not to be forgotten, and that is the unwearied attention which she bestowed on her own relations, and the munificent generosity displayed by her towards her parents and brothers and sisters.

RACINE, a town in the United States, in Racine county, Wisconsin, on the west shore of Lake Michigan, at the mouth of Root River, 18 miles south of Milwaukee. Its trade is large, and it has a fine harbour. It has iron-foundries, manufactures of machinery and agricultural implements; tanneries, flour-mills, woollen-mills, &c. The University of the North-west (Episcopalian) is situated here. Pop. (1880), 16,031; (1890), 21,014.

RACINE, **JEAN BAPTISTE**, a distinguished French dramatist, born at La Ferté-Milon in Picardy (now in the department of Aisne), December 21, 1639; died at Paris, April 21, 1699. Having been left an orphan at the age of four, he was brought up first by his maternal grandfather, and afterwards by his grandmother and aunt, both rigid Jansenists, at Port-Royal-des-Champs, the seat of the famous school of Port-Royal. At the age of ten he was sent to the College of Beauvais, and subsequently to the Port-Royal Institution, where, under the care of Lancelot and Lemaistre, he became a consummate

Grecian. At the age of nineteen he left the Port-Royal, and began the study of philosophy at the Collège d'Harcourt. When his course at this college was completed he was taken in hand by an uncle, who introduced him into the world, and encouraged him to lead a life of gaiety. To this period belong his first literary efforts, an ode called *Nymphes de la Seine*, which he composed in honour of the king's marriage, and for which he was rewarded by Chapelain, then the dispenser of the royal bounty; and two comedies, now lost, written for an actress who had charmed him. About the same time he became intimate with La Fontaine, and this intimacy was far from tending to make his life more regular, so that those of his relations who took most interest in him, and who had destined him for the church, began to be rather anxious about his prospects. In the hope of weaning him from his dissipation, and turning his thoughts again in a more serious direction, they sent him in 1661 to live with an uncle, R. P. Sconin, a canon-regular and vicar-general of the cathedral at Uzès (department Gard), whose influence it was expected would suffice for procuring him a benefice. In this last particular they were disappointed; and at the end of about two years, during which Racine had been vainly endeavouring to study theology, he returned to Paris and the world. In 1663 he was presented at court, and about the same time made the acquaintance of Boileau and Molière, and began to write for the stage. His first tragedy, the *Thébaïde*, or *Les Frères Ennemis*, was first performed by Molière's troupe at the Palais-Royal in 1664, as was also his next, *Alexandre*, in 1665. But the fact of his devoting himself to the drama did not deprive him of all chance of ecclesiastical preferment, for in 1667 he received the priory of Espinay, and afterwards the livings of Saint-Jacques de la Ferté and Saint-Nicolas de Chéay. The drama, however, continued for many years to be his sole serious occupation. His first two tragedies were merely tentative pieces, containing but few indications of the author's dramatic genius. His first master-piece was *Andromaque*, which on its performance in 1667 produced a profound impression and excited well-merited admiration. It was brought out at the Hôtel de Bourgogne, Racine having in the meantime quarrelled with Molière. The subsequent works of Racine are all master-pieces. The immediate successor of *Andromaque* was a comedy (Racine's only extant comedy), *Les Plaideurs*, a witty and delightful imitation of the *Wasps* of Aristophanes. It appeared in 1668, and was at first rather coldly received, being indeed saved only by the laughter of the king. His next pieces were *Britannicus* (1669); *Bérénice* (1670), composed at the request of Henrietta of England, who had also invited Corneille to write a drama on the same subject; *Bajazet* (1672); *Mithridate* (1673); *Iphigénie* (1674), considered by Voltaire the greatest work that the French stage has produced; *Phèdre* (1677), the last piece that Racine produced expressly for the theatre. Little is known of the private life of Racine during this period, almost all his correspondence having been lost or rather burned from a too pious respect for his memory. Hitherto he was unmarried, but for several years (from 1670) he kept up a *liaison* with an actress named Champmeslé, whose performance of the part of Hermione in *Andromaque* he had witnessed with rapture. In 1673 he obtained a seat in the French Academy. In 1675 he was nominated by Colbert a royal councillor and treasurer of France for the general government of Moulins (Bourbonnais), but he never entered on the duties of his office. His withdrawal from the theatre in 1677 was partly due to chagrin at the success of a hostile party of theatrical critics who set

up for being fine wits, and applauded one Pradon, a writer now never heard of, at the expense of Racine; and partly to feelings of remorse for his past life, heightened no doubt by reminiscences of his early education, which induced him to think of becoming a Carthusian monk. From this purpose he was turned by his friends, who persuaded him to marry. Soon after (1678) he was appointed, along with Boileau, historiographer to the king, whom he accompanied in his campaign to Flanders. After a silence of twelve years Racine, at the solicitation of Madame de Maintenon, added two other pieces to the list of his dramatic works—*E Esther* (1689) and *Athalie* (1691), the latter of which is often spoken of by French critics as the most perfect of his works. They were both intended for the pupils of Saint-Cyr, the institution founded by Madame de Maintenon. The death of Racine is said to have been hastened by grief at losing the favour of the king. He was buried at his own desire at Port-Royal, at the foot of the grave of one of his former masters, M. Hamon. After the destruction of the abbey of Port-Royal in 1709 his remains were removed to Paris, and deposited in the church of St. Étienne-du-Mont. As a dramatist Racine is usually considered the model of the classical or national tragic drama of the French, and in estimating his powers in this field it is necessary for the critic to take into account the stiff conventional restraints to which that drama is subjected. What Racine achieved within these limits is extraordinary. It has been objected to him that he has introduced too much love into his pieces, and that he has represented his tragic princesses and heroines too susceptible of the passion. To this he was led partly by his own disposition, and partly by the character of his age. He wrote as a Frenchman and for Frenchmen of the old type, in whom heroism and gallantry were combined; and no other French poet has succeeded in depicting with so much truth and tenderness, and expressing in such harmonious and beautiful verses, the feelings of a delicate and high-minded chivalry, and of a pure and ardent love. Besides his dramas Racine is the author of a number of stinging epigrams, some odes and hymns, an abridgment of the history of Port-Royal, letters, and some historical fragments on the campaigns of Louis XIV. Among his letters are two written in reply to a work of Nicole of the Port-Royal, entitled *Les Visionnaires* (1666), in which the author bitterly denounces poets and still more dramatic writers. The tone of these letters is severely sarcastic, and naturally caused great offence to his old friends and masters. Only one of the letters was published at the time they were written. Boileau having pointed out to Racine that he was only holding up to ridicule a number of excellent men, who were already persecuted by the Jesuits, the latter good-naturedly suppressed the second letter, which accordingly did not appear till after his death. After his retirement from the theatre Racine found it easy to reconcile himself with his old friends. Among the editions of the (*Œuvres Poétiques* of Racine one of the best is that published at Paris in three volumes between 1801 and 1805, which is regarded as a marvel of typography. An excellent edition of the (*Œuvres Complètes* of Racine was published in eight vols. octavo between 1865-73 in Hachette's collection of the *Grands Écrivains de la France*. It is preceded by an admirable essay on Racine and his time by Paul Mesnard. There is an English metrical translation by R. B. Boswell (two vols. 1889-90).

RACING. See HORSE-RACING.

RACK. See TORTURE.

RACKETS, or **RACQUETS**, a game played in a prepared court, open or close, with a small hard ball

and a kind of bat. The bat is about 2 feet in length, about two-thirds of which forms the shaft or handle, the remainder being an oval frame on which is tightly stretched a net-work of cat-gut. The part of the shaft by which the bat is held is covered with leather and ribbed, to enable the player to grasp it firmly. It is from this bat and the net-work, which is its principal feature, that the game derives its name (Italian, *racchetta*, for *retichetta*, an old diminutive of *rete*, Latin and Italian, a net; French, *raquette*). The close, that is, roofed court, is now generally preferred for playing in. It is an oblong rectangular space, and when of full dimensions is 80 feet long, 40 feet broad, and has walls 40 feet high. The players stand facing one of the narrow walls, which is called the front wall. The opposite one is the back wall, which, at the height of 14 feet from the ground, is broken by a gallery intended for the umpire, marker, and spectators. The walls are covered with some fine cement fitted to give a perfectly smooth and hard surface. In this country they are usually painted black, the balls used being white. In India it is the reverse. The best material for the floor is asphalt, and the players wear gutta-percha shoes, to prevent them from slipping and from injuring the floor. The lighting of the court should be from above, and the windows ought to be protected by a wire netting. The door of the court is in the back wall; it is made of some hard wood, and ought to fit the opening with great nicety, and when shut to be perfectly flush with the surface of the wall. The floor is divided in the first place by a line called the short line drawn breadthways across it at the distance of two-fifths of the length of the court (in a court of the dimensions above stated, 32 feet) from the back wall. The smaller area thus formed, that bounded on one side by the back wall, is subdivided into two areas of equal size by a line drawn from the middle of the back wall to the short line, parallel to the side walls. These are called respectively the right and the left hand corners, the former being that on the right hand of a person looking to the front wall. In the area on the other side of the short line two still smaller areas are marked off in the corners contiguous to that line. These are called the service boxes, and are formed by drawing a line of 6 feet 6 inches in length from each of the side walls parallel to the other two walls at a distance of 8 feet 6 inches from the short line, and then from the extremity of each of these lines another line parallel to the side walls and extending to the short line. Two horizontal lines are drawn across the front wall, one 2 feet 2 inches, and the other, the out or service line, 8 feet above the floor. The surface between the floor and the lower of these lines is covered with wood, which serves as a sounding-board to enable the players to know when it is struck by the ball.

The game may be played either single or double, that is, with either one or two persons on each side. It is decided by lot which side goes in first, and when there is only one player on each side the first player assumes which side of the court he pleases (usually the right), while the other stands in the opposite corner. The first player then begins to serve, in doing which he must have one foot in the service box of his side. Service consists in striking the ball with the bat so as to make it strike the front wall above the out line without previously striking any other part of the court, and then rebound into the opposite corner beyond the short line. In rebounding from the front wall it does not matter whether the ball strikes either of the side walls or not before it lights on the floor in the opposite corner of the court. If the ball is properly served the

second player must strike it before it has made a second bound, so that it strikes the front wall above the board; but in returning the ball in this manner the player may if he likes first make it strike either of the side walls. The player to whom a ball is served does not require to wait till the ball has bounded from the floor before he returns it. He may if he likes return it before it touches the floor. Such a stroke is called a volley. The ball being thus returned by the second player, the first player returns the ball in the same way, and this goes on until either player fails, which may happen in three ways, either by the ball being made to hit the sounding-board, or being struck into the roof or gallery, or later than the first bound. If it is the first player who fails, his hand is out, and it is then the turn of the second player to serve. If it is the second player, then the first scores one (an ace), and the first continues to serve, but goes to the opposite side of the court. The server's hand is also put out in serving if he causes the ball to strike any other part of the court before it strikes the front wall; if the ball strikes the server (or in four-handed rackets his partner) before bounding twice; or if the server makes two successive faults in the other conditions of serving, namely, that the ball should strike above the cut line and rebound so as to fall in the opposite corner beyond the short line. It is, however, open to the second player to take a ball improperly served in these last two particulars if he pleases, and in case of his doing so the ace must be played out. In general fifteen is game. When there are two players on each side the server and the one to whom he serves stand at the commencement of the game or a service as in single rackets, and the other two players stand in a line behind the server, the latter's partner being next the back wall. The order in which the players serve is, first, one who belongs to the side that gains the lot; then when he is put out one of the enemy, next the enemy's partner, and lastly the first server's partner. The reason of this arrangement is that the side going in first has the chance of scoring first-blood. The other details of the game must be derived from the rules drawn up by the different racket clubs. See also the article in the Encyclopedia of Sport (1898).

RACCOON or RACCOON (*Procyon*), a genus of Carnivorous Mammalia, included in the Plantigrade (which see) section of the order and in the Ursidae or Bear family. The members of this genus possess six incisors, two canines, eight premolars, and four molars in each jaw, and the group is well exemplified in the Common Raccoon (*Procyon lotor*) of North America, which derives its specific name of *lotor* ('a washer') from its habit of washing its prey before eating it, or of holding the food in the fore paws and shaking it violently backwards and forwards in the water so as to moisten and saturate it as thoroughly as possible. In size the raccoon, or *mapach*, as it is sometimes termed, averages a fox, and in outward appearance and form somewhat resembles that animal. The general body-colour is a sooty or blackish-gray, and the fur consists of a close set of under hairs, with larger outer hairs, the latter being marked black and white. The upper part of the head and the portion across the eyes are coloured dark brown; and the fur across the knee-joints presents darker colours than the rest of the body. The tail is short and bushy; it is coloured dark gray, and marked by five or six black rings. Very rarely the fur of this animal may be developed of a pure white colour. These animals, although typically carnivorous, yet seem to feed largely upon, and indeed to prefer, vegetable matters. The diet is omnivorous in fact; but in its native state it appears to subsist

upon molluscs, crabs, and marine animals, and, as already remarked, it is fond of moisture and water. The German name, *Wasch-Bär*, or 'Washing-Bear', is given to the racoon for the same reason as that indicated by the specific name *lotor*. These animals appear to be chiefly nocturnal in habits, and pass the day in sleep. They are readily tamed, and may become very familiar, and whilst under domestication may drink alcoholic stimulants and liquors to a large extent. The racoons are much hunted in North America by means of dogs, which force the animal to take refuge in a tree, whence it is dislodged by climbing. And the subtlety and cunning displayed by these animals in their endeavours to escape have become quite proverbial—expressions such as a 'sly 'coon', 'wake as a 'coon', indicating these qualities, analogous, indeed, to those displayed by the fox. The young are born generally in May, and number two or three at a birth. (See fig. at art. CARNIVORA.) The Agouara or Crab-eating Racoon (*P. cancrivorus*) is found farther south than the above species. It is generally larger than it, the tail being shorter, of a grayish-yellow tint, and marked with six black rings. The fur is blackish-gray, tinted with yellow colour, and of variable lights and shades over the different regions of the body. The eyes are surrounded by dark-brown patches, which run into the ears, and terminate in a patch on the top of the head. Although denominated 'Crab-eating', it does not appear to be specially addicted to this dietary.

RADCLIFFE, a town of England, in Lancashire, on the Irwell, 3 miles s.w. of Bury and 7 n.w. of Manchester. It possesses a handsome old church, restored in 1873, and an interesting old ruined tower. Its industries include the spinning and weaving of cotton, calico-printing, bleaching, dyeing, paper-making, engineering, &c. Pop. (1891), 20,020; (1901), 25,368.

RADCLIFFE, ANN, a novelist of some reputation, was born in London on July 9, 1764. Her maiden name was Ward. She married, at the age of twenty-three, Mr. William Radcliffe, a student of law, and afterwards editor and proprietor of the weekly newspaper called *The English Chronicle*. Her first novel, published in 1789, was *The Castles of Athlin and Dunbayne*, a Highland story. It had little success, but perhaps as much as it deserved. A Sicilian Romance published in 1790 is superior to the former, and *The Romance of the Forest* (1791) is a still further advance. Her master-piece is considered to be *The Mysteries of Udolpho* (1794), which was long very popular, though seldom to be seen nowadays. The last of her novels published during her life was *The Italian* (1797), a romance of the Inquisition. A posthumous romance, *Gaston de Blondeville*, was edited by T. N. Talfourd in 1826, together with some poetical pieces. Another work of hers was *A Journey through Holland*, &c. She died in London on Feb. 7, 1823. Mrs. Radcliffe's novels were at one time very popular, and to a certain extent they deserved it. She had a considerable power in the description of scenery, and knew how to excite and maintain the curiosity of her readers, 'harrowing up the soul with imaginary horrors, and making the flesh creep and the nerves thrill with fond hopes and fears'; but her characters are utterly insipid, the world in which they move is utterly unreal, and the conclusion of her stories, when all the wondrous effects are found to have been brought about by simple and even puerile means, is lame and impotent in the highest degree.

RADCLIFFE, JOHN, a celebrated medical practitioner, born in 1650 at Wakefield, in Yorkshire. He was educated at University College, Oxford, where he took his degree of B.A. in 1669, and of

M.A. in 1672. Having studied medicine, and taken the degree of M.B. in 1675, he began to practise at Oxford, where, having taken the degree of M.D. in 1682, he continued up till 1684. He then removed to London, and soon became very popular in his profession. In 1686 he became physician to the Princess Anne of Denmark, and he was frequently consulted by William III. after his accession. This patronage naturally secured him a lucrative practice among the nobility and upper ranks of society. He attended Queen Mary in 1694 when she was attacked by the small-pox, but was not the first medical man called, and was unable to save her. He was rather rough and blunt in his manners, and lost the good graces of Anne, and also of King William, by his plain speaking. In 1714, when Queen Anne was seized with her last illness, he was sent for, but either could not, being ill himself, or would not come. This gave rise to great ill-feeling towards him. He was twice a member of Parliament. He died Nov. 1, 1714. Dr. Radcliffe left most of his property for benevolent purposes, the University of Oxford getting a large sum. See next article.

RADCLIFFE LIBRARY, a library founded in connection with Oxford University out of funds destined for the purpose by Dr. John Radcliffe (see above). It was formally opened on the 13th of April 1749. The works belonging to it were chiefly in the natural sciences and medicine. By arrangement with Dr. Radcliffe's trustees they were transferred to the University Museum in 1861, and are in charge of a special librarian. The library building erected by the Radcliffe trustees is now used as a reading-room in connection with the Bodleian Library. It is circular in form, and surmounted by a lofty dome, forming a conspicuous feature in the more distant views of Oxford. In the Radcliffe building (or 'Camera') are kept a large number of modern books, including a select library for the use of students. There are three Radcliffe fellowships in the gift of the university, each of the value of £200 per annum and tenable for three years. They are for the encouragement of medical studies, and the holder must travel and study abroad. There are also a Radcliffe Infirmary and Radcliffe Observatory in Oxford.

RADEBERG, a town of Saxony, 9 miles north-east of Dresden, on the Great Roder. It has important glass-works as well as a paper-mill and other industrial establishments. Pop. (1895), 10,294.

RADETZKY, JOSEPH WENCESLAUS, COUNT, an Austrian field-marshal, was born on the 2nd January, 1766, at Trebnitz, in Bohemia, joined a Hungarian regiment of horse in 1784, took part in the campaigns of 1788-89 against the Turks, and of 1792-95 in the Low Countries and on the Rhine. In 1800 he received the command of Archduke Albert's regiment of cuirassiers, and in this capacity distinguished himself greatly at the battle of Hohenlinden. On the recommencement of hostilities, after the peace, he proceeded as major-general to Italy, where, under Davidovich, he performed signal services. During the campaign of 1809 he became lieutenant field-marshal, and served at the battle of Wagram, where, as also in the retreat of the Austrian army, he displayed distinguished ability. After the Peace of Schönbrunn he was made chief of the quartermaster-general's staff, and a member of the state council of war, in which he set himself actively to work in reorganizing the Austrian army. On the final rupture of Austria with France he again took the field, and was wounded at the battle of Leipzig. In 1821 he received the appointment of commander of the fortress of Olmütz. The commotions in Italy following the French revolution of 1830 called him to that country, where a great part of his subsequent life

was spent. In 1836 he was created field-marshal. On the breaking out of the insurrection at Milan on the 18th March, 1848, he maintained a fight for several days in the streets, and then retreated with his forces to Verona. On the Sardinian king Charles Albert taking the field Radetzky assumed the offensive, advanced to Mantua, crossed the Mincio, took the lines of Curtatone, and marched up the river. The insufficiency of the force at his command compelled him to fall back on Mantua, while Peschiera and the heights of Rivoli fell into the hands of the enemy, who effected their passage across the Adige. The situation of Radetzky was for the moment extremely critical, but by taking the heights of Sona and Sommacampagna, and occupying those of Custoza, he obstructed the advance of the Sardinians across the Mincio. He was now in a position to offer battle, and gained on the 25th July the victory of Custoza, which compelled Charles Albert to retreat to Milan, and then evacuate the city after a short contest. Through his energetic talents Radetzky thus preserved Lombardy to Austria. An armistice having been concluded with Sardinia he next occupied himself with the blockade of the revolted city of Venice, but hurried from it in March, 1849, on the resumption of hostilities with Charles Albert. He assembled his army at Pavia, crossed the Ticino, and after the preliminary successes at Vigevano and Mortara gained so decided a victory over the Piedmontese army at Novara, on 23d March, that their king abdicated in favour of his son Victor Emmanuel, and a treaty was concluded which secured for the present the Austrian supremacy in Italy. Venice surrendered to Radetzky in August of the same year. His energies were then devoted to consolidating and strengthening the Austrian power in North Italy, an undertaking in which his vigour and ability were eminently displayed. Honours and rewards of all kinds were now showered upon him. He took up his residence at Milan, and died there on the 5th January, 1858.

RADIATA, one of Cuvier's four great sub-kingsdoms or divisions of the animal kingdom, the other four being the Articulata (or Annulosa), Mollusca, and Vertebrata. The Radiate animals, according to Cuvier, characterized in chief by their round or radial symmetry, included all the Protozoa (which see) and such forms as are now termed Coelenterata (Hydræ, Zoophytes, Sea-anemones, Corals, &c.), together with the Star-fishes, Sea-urchins, Sea-cucumbers, Tape-worms, &c., afterwards put in a sub-kingdom Echinozoa or Annuloida. In addition to these groups the Molluscan class Polyzoa (which see) was erroneously included by Cuvier in his Radiate group.

In modern zoology, and as the structure or morphology of animal forms came to be better understood, it was seen that Cuvier's great Radiate group must be divided into several other divisions, since the included radiate forms in many respects were found to be of very dissimilar kinds, and such as could not naturally or reasonably be allowed to appear related in the system of classification. Accordingly the Protozoa were first distinctly separated out from the Radiata to form a sub-kingdom of themselves. And in due time the group of Coelenterate animals was founded by Frey and Leuckhart to include those forms which possess an imperfectly specialized digestive system, whilst the Echinozoa or Annuloida similarly absorbed the Star-fishes, their allies, and the Scolecida or Tape-worms, &c.

The Echinozoa, perhaps, of the three groups into which the Cuvierian Radiata have been divided present the least satisfactory appearance when regarded according to morphological laws and in relation to the clear structural affinities of its included forms. Indeed

by some naturalists the group Echinozoa is regarded as a 'refuge for the destitute' in that the animals included in this sub-kingdom are so diversified and dissimilar. But to this observation we might reply that 'refuges for the destitute' are very necessary and useful institutions in zoological classification; and that if the animals included in the Echinozoa (with the exception of the class Echinodermata) are dissimilar, then the sub-kingdom has its use and value as bringing together animals which would not be at home in any of the other sub-kingdoms of the animal world. And we might further maintain that the Echinozoa are related by certain characters, which, if not of very prominent kind, are yet not more indefinite than are possessed by some groups in other sub-kingdoms. In some recent classifications, however, the Echinodermata are treated as so distinct that they may form a sub-kingdom (or similar division) by themselves, while the Tape-worms, &c. (Scolecida), are placed in the sub-kingdom Annulosa.

RADIATION, one way in which a body gives out heat. Heat may either be radiated or conducted. When we feel the heat of the sun or the heat of a fire we are made sensible of radiant heat. The sensations produced when we take hold of a hot poker or a frosty pump handle are due to the conduction of heat. In liquids and gases heat is said to be carried from one part of the liquid or gas to another by convection, but convection is, when properly considered, simply conduction.

The phenomena of radiant heat are identical with those of light, and the same hypothesis as to origin and mode of propagation will serve for both light and heat. (See UNDULATORY THEORY.) In the solar spectrum we find that the violet portion has a very small heating value, and that the heating power is most intense some distance below the red, where the spectrum is invisible. If we consider the effects of a pencil of rays as it comes from the sun, they are resultant effects of a great number of sets of vibrations in the supposed ether, which sets of vibrations do not naturally interfere with one another, and each set may be conceived of as acting independently of all the others. The velocity of approach being the same, and the number of vibrations per second being different, the wave-lengths will be different, and the different physical effects are due solely to differences of wave-length of the several sets of rays.

When a pencil of the sun's rays traverses a glass prism, entering the glass from air, the sets of rays are more bent towards the perpendicular to the surface of the prism as their wave-length is smaller; and the same will be true when the prism is made of other substances, such as rock-salt, which are denser than air, so that we may call rays of shorter wave-length rays of greater refrangibility, and rays of longer wave-length rays of less refrangibility. This difference of bending enables us by means of prisms of different materials to separate a pencil of rays into its component sets, and we can examine these separately when they are spread out into what is called a spectrum.

If a photographic plate be exposed in the solar spectrum we obtain a picture of the chemical effects on salts of silver, for the plate, on being developed, will have silver deposited most thickly where the chemical action was greatest. Our eye can judge of the part of the spectrum which is brightest, and by means of a linear thermo-multiplier we can lay down a curve exhibiting the heat intensity in moving from one end of the spectrum to the other. It will be seen that the maximum of chemical action is produced by sets of rays which vibrate more quickly than those which give the maximum of light, and

these again have a shorter wave-length than the sets of rays which have the greatest heating effect. For reasons to be given below, in order to get accurate results in the above experiment the material of which the prism is composed should be different when we examine for light or chemical action from that of the prism which is used when we examine for heat. It is found that in order to lay the simple sets of rays beside one another, and with as little overlapping as possible, the beam of light should come from a narrow slit, and the purity of our spectrum will depend on the thinness and perfection of the beam of light incident on the prism. See SPECTRUM.

No substance is perfectly diathermic, that is, every substance through which heat is radiated absorbs some of the heat. When a simple set of rays, that is a set of rays having all the same wave-length, is radiated through a medium, if we suppose the medium split into thin equal films the fraction of the total quantity of heat entering any film which is absorbed by that film is constant for all the films, but different substances have a difference of choice as to the rate of absorption for rays of different refrangibility. Some vibrations in a mixed beam will be absorbed at once, and the rate of absorption of the remainder may be so slow that after the beam has passed through a thin plate of the substance, passing it through additional thicknesses will not appreciably affect it. The beam in this case is said to have been sifted by the first plate. Dry air absorbs very few of the sun's rays, but the experiments of Dr. Tyndall on moist air show that a damp atmosphere has a powerful influence on the heating effects of the sun. The heat of the sun has been sifted in passing through the atmosphere, and when it reaches us appears to pass through air without any loss. In saying of a body that it is more or less diathermic we should specify the source of heat with which we have experimented. Common glass allows most of the sun's heat to pass freely, but it will intercept most of the heat from a fire. In the case of a green-house the sun's rays pass freely through the glass, and are converted to rays of less refrangibility against the floor walls, &c., and the glass will not permit this heat to be radiated through it, so that the inside of the hot-house is maintained at a high temperature. When a body intercepts radiant heat it becomes heated, and those vibrations which it absorbs are the vibrations which it will produce when radiating as a heated body. This in the case of light is the foundation of all spectral analysis. By means of the vibrations absorbed or produced by the different chemical elements these elements are detected in their compounds. Bodies which absorb all or nearly all the heat vibrations from a given source are said to be adiathermic to that kind of heat.

It has hitherto been impossible to determine the velocity of invisible heat rays, but those rays which give both light and heat effects have a velocity of about 190,000 miles per second, and it is all but certain that this is also the velocity of obscure heat.

When heat is radiated through a medium which does not absorb it, the intensity at any point is inversely proportional to the square of the distance of that point from the heated body.

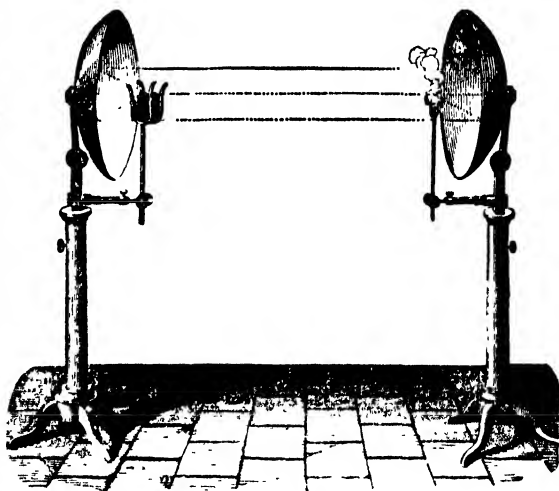
All bodies radiate heat continuously, and at the same time absorb heat which is being radiated from

surrounding bodies, so that there is a constant tendency to arrive at equality of temperature. Newton's law of cooling states that *the rate at which a body loses heat is proportional to the difference between the temperature of its surface and that of the inclosure*. It is found, however, that this law is not exactly followed, and the experiments of MM. Dulong and Petit on the velocity of cooling of a thermometer in vacuo show that for great variations of temperature the law is not nearly true. They found that when the body was 200° C. in excess of the inclosure the rate of cooling was 7.40° C. per minute, but at 100° C. the rate was 2.30° C. per minute, and not 3.70° C., as Newton's law would suppose it to be.

Newton's law is a useful approximation when the excess of temperature does not exceed a few degrees.

The theory which supposes a constant interchange of heat among bodies by radiation was called by Prevost, its author, *the theory of movable equilibrium of temperature*. According to this theory a body which remains at constant temperature just radiates as much heat to surrounding bodies as it receives from these bodies. A body rises in temperature when it absorbs more than it radiates, and it falls in temperature when it radiates more than it absorbs. This subject has been very completely investigated by Professor Balfour Stewart and others, and very important results have been obtained. See HEAT, RADIATION OF.

Dark heat may be reflected, and follows the laws of reflection of light. Two mirrors of polished brass



(the mirrors should be parabolic, but those of a spherical form are easier to manufacture, and will answer all practical purposes) are placed with their axes in the same straight line in the position shown in the figure, and at any convenient distance apart. An iron ball heated to dull redness is placed in one focus and a piece of phosphorus in the other. The course of the rays of heat is indicated by dotted lines, and if in performing the experiment the foci have been accurately determined the piece of phosphorus will be ignited by the heat radiated from the hot ball and reflected by the mirrors.

Professor Forbes has experimentally demonstrated that all kinds of heat may be polarized as light is polarized. He used two plates of tourmaline cut parallel to the axis of the crystal, and he found that most of the heat was absorbed when the position of the plates was such that the axes of the crystals were

at right angles to one another. He also used plates of mica split by heat for his experiments on polarization by refraction and reflection. He found that the mica plates, although nearly opaque to light, allowed a large portion of heat to pass, and if the rays make a proper angle with the surface those which pass through are considerably polarized. These may be analyzed by a second plate of mica, and it is found that giving this second plate the same inclination as the first, and turning it round, as in the case of the similar instrument for light (see POLARIZED LIGHT), the maximum transmission of rays through the apparatus occurs when the plates of mica are parallel, and the minimum when the movable plate has been turned through a right angle.

Professor Forbes proved the circular polarization and depolarization of heat, and the turning of the plane of polarization by solutions of sugar and other substances has also been demonstrated.

Experiments on radiant heat have been very much facilitated by the thermo-multiplier (see THERMO-ELECTRICITY), but even with this instrument heat indications are given slowly compared with the quickness by which the eye judges of the presence or absence of light.

RADICLES, or **RADICALS**, a name given to certain groups of elements which remain united throughout many reactions. Radicles are sometimes known in the free state; thus, the group called cyanogen (CN) is a well-known gas; it also enters into the formation of a large number of compounds. On the other hand, there are many radicles which have never been isolated; thus, the group ammonium (NH_4) is only known in combination with other elements. See CHEMISTRY.

RADIOLARIA. See POLYCYSTINA and PROTOZOA.

RADISH (*Raphanus sativus*; natural order, Crucifere), a well-known esculent root, universally cultivated in temperate climates, and used as a salad, &c. The plant was originally brought from China and Persia, but has been cultivated in Europe from time immemorial. There are a number of varieties, divided into two chief classes, the long-rooted and the turnip-rooted, the colour being scarlet, purple, or white. It is the pungent root that is chiefly used raw as a salad, but the young leaves may also be so used, and the pods are sometimes pickled.

RADIUS, in geometry. See DIAMETER.

RADIUS, the bone of the fore limb of vertebrate animals, which, as in man, when the arm is supinated or laid flat, with the palm upwards, lies to the thumb side of the limb. This side is therefore termed the *radial* side of the limb, in contradistinction to the *ulnar* or opposite side, so named from the ulna or neighbouring bone, which, with the radius, constitutes the forearm. In man the radius is a long, cylindrical bone, bearing a *neck* and rounded *head* at its upper portion, the head articulating with the *ulna* and by a synovial joint with the *humerus* or bone of the upper arm. It is broadened at its lower (wrist or *carpal*) extremity, and its posterior surface is grooved for the reception and passage of the tendons of muscles. At the carpal extremity it articulates with the ulna. The upper end of the radius turns, in the motions of the fore-arm, on the double surface afforded by the pivot surface of the humerus and the slightly cup-like depression of the ulna. At its lower end the radius rotates round the lower end of the ulna. In the action of *supination*, as above defined, the radius lies parallel with the ulna, the lower extremity of the radius lying to the outer side of the neighbouring bone. In *pronation*, where the palm is turned downwards, the radius turns about on its own axis and around the ulna below, and crossing the latter bone—as when the

hand and arm hang downwards with the palm turned backwards.

The radius is always represented in the forearm of Vertebrates above fishes, in which latter forms it is difficult or impossible satisfactorily to determine its representative. In birds, however, in which movements of pronation and supination would render the fore limbs inefficient as wings, the radius is much smaller than the ulna, and is subordinate in its development to that bone. It is very short and flat in Cetaceans, and is ossified in Sirenia at each end to the ulna. In the Frog and Camel the radius is apparently the sole representative of the bones of the forearm; and in Bats and Ruminants generally it forms the almost sole support of the forearm. In the dog, elephant, and Ungulates generally, the normal position of the radius is a crossed position with regard to the ulna, as seen in pronation in man. In Apes, Sloths, &c., movements of pronation and supination are also performed.

RADIUS VECTOR. A point in space is specified if we know its distance from a fixed point and the angles which its direction from this point makes with two fixed directions. We may suppose any curve whatever as being traced by one extremity of a straight line whose other extremity is fixed and whose length and direction vary; such a line is at any instant the radius vector of the point of the curve which it is tracing at that instant.

In the case of a circle, when the centre is chosen as the fixed point or origin, the radius vector is of constant length, and the length of the curve between any two points measures the angle turned through in describing that curve, but if any other point is chosen for origin the radii vectors for different points will not be equal. When a point is specified by the length and direction of its radius vector it is said to be given in polar co-ordinates. In treating questions of analytical geometry by the method of polar co-ordinates the origin (as instanced above in the case of the circle) may be often chosen so as to simplify the problem, and the character of the question may be such that it is more easily dealt with by the polar method than by the Cartesian method. This is notably the case in dealing with questions as to the paths of bodies acted on by central forces. The earth moves in an orbit which is approximately an ellipse, in one focus of which the sun is situated. The earth's path is conceived of as having been traced by the extremity of a right line of variable length revolving about the sun's centre, which is taken as a fixed point, and in astronomy the radius vector of any point of an orbit is the line from that point to the centre of force round which the orbit is described. See MATHEMATICS—Polar Co-ordinates.

RADNOR, or **RADNORSHIRE**, an inland county in South Wales, bounded north by Montgomeryshire and Shropshire, east and south-east by Herefordshire, south and south-west by Brecknockshire, and west by Cardiganshire. The area is 301,164 acres, of which more than half is under crops and pasture. The surface throughout is hilly, in some parts approaching to mountainous, the highest summit of the Forest of Radnor reaching an elevation of 2163 feet above sea-level. The principal portion of Radnorshire is composed of the strata forming the Silurian system, but on the west and north-west side of the county the upper beds of the older rocks, composing the Cambrian system, make their appearance. Syenite and porphyry occur in many parts; and a coarse amygdaloidal trap is met with. There are several medicinal mineral springs, some of which are in good repute. Oats and wheat are the principal crops. But the chief dependence of the farmer is on the stock reared on the pasture-land and com-

mon-land, which not only support large numbers of sheep, but, in the more sheltered parts, cattle of all sorts. The cows are principally of the Herefordshire breed. The draught-horse in general use is rather small, but capable of enduring great fatigue. The original Welsh ponies are still bred in the mountains. Large quantities of butter are made. The ancient forests of Radnorshire, which were of great extent, have long since disappeared. The manufactures are trifling. The chief manufacture is flannel. None of the rivers are navigable. The county returns one member to Parliament; it contains no parliamentary borough. The county town is New Radnor. Pop. (1891), 21,791; (1901), 23,263.

RADNOR, New, a former parl. borough and small market town in South Wales, in the county of Radnor. The town, on a plain in the Vale of Radnor, 60 miles N.N.W. of Bristol, and $3\frac{1}{2}$ miles north-west of the village of Old Radnor, has a population of only about 500. The borough, now included in the county, comprised a district about 30 miles round, with a population of 2190. It united in returning a member to Parliament with Cefnlllys, Knighton, Knucklas, Presteigne, and Rhayader.

RADOM, a government in Russian Poland, formed in 1845, and confined to its present limits in 1867. It is bounded on the north by the government of Warsaw, on the north-east by that of Siedletz, on the east by that of Liublin, and by Galicia and the government of Kielez on the south; area, 4758 square miles. The soil is generally fertile, but rather stony in the southern parts. The meadows, which cover an area of nearly 300 square miles, produce about 70,000 tons of hay annually. The corn crops grown are wheat, rye, barley, buckwheat, and hay. The principal manufactures are woollens, leather, and oil. There is also a considerable number of breweries. Pop. (1897), 820,363.

RADOM, a town in Russian Poland, on the Radomka, 85 miles south of Warsaw, capital of the government of the same name. It has a church and convent belonging to the fifteenth century; manufactures of tin, oil, vinegar, and leather; and two annual fairs. Pop. 25,000.

RADZIWIŁŁ, the name of an ancient family, one of the most famous in Poland, and originally descended from Narimund, grand-duke of Lithuania. Among its most distinguished members are:—1. **NICOLAS the Black**, son of John the Bearded, and palatine of Wilna. King Sigismund Augustus, who owed much to his services, held him in the highest esteem, and gave him the command, in 1552, in the war of the Poles against the Polish knights. He also commanded in the war against Russia in 1561. When ambassador to the court of Charles V. he gave due attention to the interests of his country, and having become a convert to the Reformation, zealously espoused its cause, and showed his enlightened interest in it by procuring a translation of the Bible into the Polish tongue. He died in 1567, leaving several sons, who, instead of walking in his steps, went back to Popery. George, archbishop of Cracow, bishop of Wilna, and a cardinal, was the most zealous and most bigoted among them.—2. **CHRISTOPHER II.**, of a different line, military governor of Lithuania and palatine of Wilna, belonging to the Protestant Church, was the enemy of King Sigismund III., who, after promising him several crown appointments, had bestowed them on Sapieha. In the same way as in Germany during the Thirty Years' war the Protestants were oppressed during the government of Sigismund. C. Radziwill, after the death of Sigismund, in 1632, undertook their defence at the Diet of Warsaw, and with such success that he obtained complete toleration for them.

Enjoying the confidence of Wladislaw IV. he commanded in the war against Russia, and rendered important service to his king and country. He died in 1640.—3. **BOGUSLAW**, Prince Radziwill, son of Prince James and Sophie Elizabeth, margravine of Brandenburg, was governor in Prussia, 1657–69, and rendered important services to it both by his administration and endowments to universities and schools.—4. **CHARLES**, Prince Radziwill, palatine of Wilna and grand-commander of Lithuania, possessed of an income of 1,300,000 dollars. In his own and his country's service he maintained 6000 soldiers at his own expense; and fully aware that nothing good to Poland could come from Russia, he was the enemy of Czartoryski and the Russians, and an adherent of the Saxon party. He was an ardent supporter of the confederation of Bar, and was several times obliged to exile himself. He spent the periods of his exile in Turkey, Italy, Germany, and France. For three years he took part in the labours of the constituent diet at Warsaw, but died in 1790, before the new constitution was completely drawn up and promulgated (May 3, 1791).

RAEBURN, **SIR HENRY**, a very eminent portrait-painter, was born at Stockbridge, near Edinburgh, March 4, 1756. At the age of fifteen he was bound apprentice to a goldsmith in Edinburgh. On the expiration of his apprenticeship he became professionally a portrait-painter; and with the view of improving in his art he repaired to London, and afterwards spent two years in Italy, diligently engaged in studying the great masters; he returned in 1787, and established himself in Edinburgh. Here he soon rose to the head of his profession in Scotland—an eminence which no artist presumed to dispute with him during the remainder of his life. The most interesting of his works are a series of half-length portraits of his literary and scientific friends. He was elected R.A. in 1815, and in 1822, when George IV. visited Scotland, was knighted, and appointed painter to his majesty for Scotland. He did not long survive those honours, as he died on 8th July, 1823. See the Life by W. R. Andrew (1894).

RAFFLE, a game of chance, in which several persons each deposit part of the value of a thing for the chance of gaining it.

RAFFLES, **SIR THOMAS STAMFORD**, a distinguished British administrator, the son of a ship captain, was born at sea, off Jamaica, in 1781. In 1810 he was appointed agent of the governor-general to the Malay states; and the following year, on the reduction of Java by the British, he was nominated lieutenant-governor of the island. In this capacity he continued till the island was given up to the Dutch in 1816, when he returned to England with an extensive collection of the productions, costumes, &c., of the Eastern Archipelago. The year following appeared his *History of Java* (second edition, 1830). Having been nominated to the lieutenant-governorship of Fort Marlborough, the seat of government of the then British possessions of Bencoolen, in the Island of Sumatra, he went out in 1818 to fill this post. Here he remedied many disgraceful abuses. In 1823 he laid the foundation of a literary institution consisting of a college for the encouragement of Anglo-Chinese literature. In the following year he embarked for Europe; but a fire breaking out in the ship the vessel was destroyed at sea, the crew and passengers saving their lives with difficulty in the boats. He died in 1826.

RAFFLESIA ARNOLDI. This gigantic flower was discovered in the interior of Sumatra. It is parasitic on a species of *Cissus*. The whole plant seems to consist of little else beyond the flower and root. It is dioecious, and the female flowers are unknown.

The perianth consists of a ventricose tube crowned with a ring, and divided at the summit into five equal lobes. The stamens are very numerous. The diameter of the flower is 3 feet, and some of its parts are $\frac{1}{2}$ inch in thickness. It is capable of containing 12 pints of fluid in its cup. The flower is said sometimes to have a weight of 14 lbs. The plant is named after its two discoverers, Sir Thomas Raffles and Dr. Arnold, who came upon it while making an excursion into the interior of Sumatra. See next article.

RAFFLESIACEÆ, or **PATMAWORTS**, a natural order of dicotyledonous plants, stemless and stalkless, and consisting merely of hermaphrodite or dioecious flowers, growing immediately from the surface of branches, and immersed among scales. Their principal characteristics are a superior, globose or campanulate perianth, with five-parted limb; numerous distinct anthers adhering by the base; inferior, one-celled ovary; conical styles as numerous as the placentæ, and run together with the column, but projecting beyond it; and a fruit in the form of an indehiscent pericarp with numberless seeds. The habitats of the species are the East Indies, especially Java and Sumatra, where they grow on the stems of plants of the genus *Cissus* (closely allied to the vine); and South America, where they grow on the branches of leguminous plants. The *Rafflesia Arnoldi* was the first of the order to be discovered. One of the species, *Rafflesia patma*, is employed in Java as a powerful styptic. Others possess similar properties. See preceding article.

RAGATZ, a town of Switzerland, in the south-east of the canton of St. Gall, on the Tamina, much resorted to for its beautiful scenery and mineral waters. The streets are lighted by electricity, and there are various institutions in connection with the bathing establishments. The waters are useful in cases of gout and rheumatism, as well as in the nervous affections of women. Ragatz is a station on the railway from Rorschach to Chur. Pop. 2000. See **PREFFERS**.

RAGGED SCHOOLS, institutions supported by voluntary contributions for the education of neglected children and the consequent prevention of juvenile crime. The idea of forming such schools was due to the celebrated Portsmouth cobbler, John Pounds, who about 1819 began to take in the ragged children of the district in which he lived and teach them while he was at work. This he continued till his death in 1839. The success of the plan caused a number of more influential persons to take the matter up, and in 1838 a ragged Sunday-school was opened in London. In 1841 the first feeding-school, in which the children are not only educated but kept and fed for the day, was started by Sheriff Watson in Aberdeen. In 1845 a similar school was opened by Dr. Robertson of New Greyfriars in the Vennel at Edinburgh. But what gave a greater impetus than anything else to the ragged school scheme was Dr. Guthrie's Plea for Ragged Schools, published in 1847. It had an immense circulation, and was followed by the extension of the system to every considerable town in the kingdom. The name ragged schools was first adopted in 1844. Owing to the education acts, and especially the introduction of compulsory school attendance and abolition of fees, many of these schools were absorbed by the school-boards, and altogether they may be said to be a thing of the past.

RAGLAN, **FITZROY JAMES HENRY SOMERSET, LORD**, was the youngest son of Henry, fifth Duke of Beaufort, and born on the 30th September, 1788. He entered the army in 1804; was attached in 1807 to the Hon. Sir Arthur Paget's embassy to Turkey; and the same year served on Wellington's staff in the expedition to Copenhagen. Subsequent to this

he became his military secretary—an office which he filled through the whole of the Peninsular campaign. He was slightly wounded at the battle of Busaco, and greatly distinguished himself at the capture of Badajoz. In 1814 he acted for a short time as secretary to the embassy at Paris, and was minister plenipotentiary there from January to March, 1815. At Waterloo he lost his right arm, and received subsequently the appointment of aide-de-camp to the prince regent, the dignity of K.C.B., and several foreign orders of merit. From 1816 to 1819 he acted as secretary to the embassy at Paris; and from 1819 to 1852 as military secretary to the Duke of Wellington during the latter's tenure of the posts of master-general of the ordnance (1819-27) and commander-in-chief (1827-52). He attended the Duke of Wellington at the Congresses of Vienna and Verona, and in 1826 accompanied him to St. Petersburg on his mission to congratulate the Emperor Nicholas on his accession. In 1852 he was made master-general of the ordnance, and in October of the same year was elevated to the House of Peers by the title of Baron Raglan. On the breaking out of the Russian war he received the appointment of commander of the forces, and proceeded in that capacity to Turkey. The incidents of the campaign are well known. Throughout that eventful period Lord Raglan displayed great personal bravery, if not military genius, and rendered himself universally beloved throughout the army by his amiable and conciliatory temper. The difficult position in which he was placed, and the total inefficiency of the commissariat and other arrangements, over which he had little or no control, hampered and impeded his movements; and in estimating his abilities, as displayed in this conjuncture, it is necessary to make large allowance for these circumstances. The disastrous repulse of the allies in their attack on the Redan, 18th June, 1855, seems to have weighed heavily on his spirits, and the disease under which he was labouring at the time—a mild form of cholera—was from that date greatly aggravated; and he expired in the camp before Sebastopol on the 28th of the same month. See **Kinglake's Invasion of the Crimea**.

RAGMAN ROLLS, documents containing a record of the acts of allegiance extorted by Edward I. of England from the nobility and gentry of Scotland in 1291-92 and 1296. The name is more particularly given to the documents recording the acts of allegiance and homage paid to Edward in the course of his progress through Scotland in 1296. The document was delivered back to the Scotch along with other records and muniments in 1329 in terms of the Peace of Northampton. It is now deposited in the Record Office, and consists of four large rolls of parchment, formed by stitching together thirty-five smaller pieces. It has been published in Prynne's Records in an abridged form, and also, along with the earlier roll, for the Bannatyne Club in 1834. In the introduction to the latter publication will be found the various conjectures—none of them, however, conclusive—that have been advanced regarding the etymology of the term *ragman*.

RAGS, worn fragments or shreds of textile fabrics. Rags, valueless though they may be for most purposes, are yet of great importance for some purposes, particularly in paper-making. (See **PAPER**.) Besides the rags collected in the United Kingdom, the article is imported in large quantities from various foreign countries. Linen and cotton rags for paper are imported principally from Germany, Holland, Belgium, France, Austria, and Russia. Woolen rags are also imported in considerable quantities from the continent of Europe. Woolen rags, not being available for paper, are much used for manure;

but those of a loose texture, and not too much worn, are unravelled by means of machinery, and mixed up with good wool, to form what is known as *shoddy*, with which cheap woollen goods are made; while the refuse is pulverized and dyed various colours, to form the flock used by paper-stainers for their flock-papers. Woollen rags, not for manure, are imported to the annual value of some £600,000. The extensive use of wood pulp, esparto, and other materials for the manufacture of paper has materially affected the rag trade. For example, the value of rags for paper-making imported in 1861 was £338,713, against £7293, the value of esparto and other materials; while in 1900 the value of the former import was £161,867, and that of wood pulp had risen to £3,531,007. The import of woollen rags for 1900 was valued at £577,803. The United States competes closely with Great Britain for the purchase of continental rags, and even enters the English market, as is shown by the large quantities annually exported to that country.

RAGUSA, a seaport town of Austria, in Dalmatia, on a peninsula in the Adriatic, formerly a republic, with a territory of 500 square miles and 60,000 inhabitants. It is surrounded by old walls flanked with towers and bastions, but possesses little strength. The houses are built of excellent stone, many of them with handsome balconies. The more remarkable edifices are the cathedral, the church and convent of the Franciscans, the church and convent of the Jesuits, the former considered the finest building in Ragusa, and the latter now used as a military hospital; the governor's palace, an ancient structure in the Florentine style, with fine arcades and arched windows; the custom-house; the Opera Pia, a kind of house of refuge for young females; and various other charitable institutions. The manufactures, of little importance, consist chiefly of silk and woollen goods, and leather; but the trade with Italy and the Levant is extensive, though it has harbour accommodation for small vessels only. Ragusa is of very early origin, and is supposed to have been founded by Greeks in 656. It fell under the power of the Greek emperors, but finally asserted its independence, which it successfully maintained, both against the Turks and the Venetians. Its most flourishing period was from 1427-40, and it preserved its liberty by the payment of a tribute to the Porte. So well known were its trading-vessels, that our word *argosy* is derived from the name of this port. In 1806 it was taken possession of by the French, and in 1810 was incorporated with the government of Illyria. In 1814 it was given to Austria. It has repeatedly suffered much from earthquakes, more especially that of 1667, by which great part of it was laid in ruins. It has some popularity as a winter health resort. Pop. (1880), 7245; (1890), 11,177.

RAGUSA, a town of Sicily, in the province of Syracuse, 29 miles w.s.w. of Syracuse, on the right bank of the river of its name. It is romantically situated, has considerable manufactures of cotton, and a trade in corn, wine, oil, &c. It is supposed to stand near the site of the ancient Hybla Heræa. Pop. 25,000.

RAHWAY, a town of the United States, in Union county, New Jersey, 39 miles north-east of Trenton; with seven churches, an academy, a female institute; a tannery, a distillery, a paper-factory, and numerous flour, grist, and saw mills. Pop. (1890), 7105.

RAIBOLINI, FRANCESCO, usually called FRANCESCO FRANCA, a famous Italian painter, regarded as the head of the Bolognese school, was born at Bologna in 1450. He was apprenticed to a gold-

smith, and distinguished himself by the excellence of his workmanship in metal. He executed a number of most beautiful medals, and was appointed superintendent of the mint at Bologna, a post he held at his death. As a painter Perugino appears to have had considerable influence on him, but little more is known of the circumstances of his life than that his school at Bologna was numerously attended, and that he died there in 1518. He excelled particularly in Madonnas, and executed two admirable frescoes in the oratory of St. Cecilia at Bologna, but his most famous work is a St. Sebastian in the church of S. Giacomo Maggiore in the same city. Three works of his are in the National Gallery, one of which, the Virgin and Two Angels weeping over the Dead Body of Christ, is of rare power. He was also an able portrait painter. Raibolini's son, Giacomo, acquired considerable celebrity. See Julia Cartwright's Mantegna and Francia (1881).

RAIL (*Rallus*), a genus of Gallatorial or Wading Birds, forming the type of a distinct family (Rallidæ) of that order. The rails possess bills of moderate length, not longer usually than the head, and of a wedge-shape and compressed form. The legs are shorter than in the generality of Wading Birds, the toes, however, being very long, and provided with claws or nails of considerable length. The wings are of moderate size, and the neck is short, the head being small. The tail is short, and the body presents generally a somewhat compressed form. They generally inhabit swampy places, the food consisting of vegetable and animal matter. The nest is usually placed on the ground amid sedges and reeds, and consists of dried grasses woven together. The Common or Water Rail (*Rallus aquaticus*—shown at article ORNITHOLOGY, Pl. VI.) possesses a slender elongated bill, both mandibles being slightly curved; the throat is whitish, the sides of the head, breast, belly, and neck being of a leaden colour; the upper plumage is reddish-brown, with deep black in the middle, the sides being black, striped with transverse white bands; the lower tail-coverts are white, the bill reddish and brown, and the feet of a brown flesh-colour. The males are generally the larger, and the sexes are of similar plumage. The Common Rail occurs all throughout Europe. These birds do not appear to be migratory in habits, like their allies the Crakes. The Rail is little known to ordinary observers, chiefly on account of its retiring habits. The eggs are yellowish-white, marked with brown spots; and the young, when first hatched, are covered with a black down. The flesh is very palatable. For the Land Rail see CORNCRAKE.

RAILWAYS, or RAILROADS, are roads on which two lines of smooth and parallel bars are placed in order to diminish the resistance to transport of the wheeled vehicles that are run upon the bars or rails, and to enable them to be drawn at higher velocities. The necessity for railways originated in the requirements of the coal traffic of Northumberland, where the first railways, formed on the plan of making a distinct surface and track for the wheels, were constructed. In 1676, near Newcastle-on-Tyne, the coals were conveyed from the mines to the banks of the river 'by laying rails of timber exactly straight and parallel; and bulky carts were made, with four rollers fitting those rails, whereby the carriage was made so easy that one horse would draw four or five chaldrons of coal'. The rapid wear of timber led to the substitution of cast-iron rails 100 years afterward, about 1776, to replace the wooden ones; and being limited in width, they were formed with a continuous flange or ledge on their inner edge, to keep the wheels on the track. The roads went by the name of 'tram-roads'. The lead-

ing objection to this system was that the rail was liable to be covered with dust or gravel. Jessop in 1789, to obviate these disadvantages, laid down at Loughborough cast-iron 'edge rails', from which the guiding ledges were removed and applied round the edges of the wheels, forming flanges, the rail being elevated sufficiently to allow the descending flange to clear the ground. This appears to have been the first system of rails laid on cast-iron chairs and on sleepers; the chairs (so called because they support the rail) being placed at short intervals, and the sleepers (so called because they are supposed to rest undisturbed in the ground) consisting of stone blocks placed under the chairs. But the rails, being made of cast-iron, proved to be liable to fracture under the loaded wagons and the locomotive engines by which they were drawn, and accordingly, in 1820, Mr. Birkenshaw introduced the 'fish-belly' rail, which was of rolled wrought-iron, similar in form and mode of support to Jessop's rail. This form of rail grew into favour, and was adopted in the construction of the Liverpool and Manchester Railway, which was opened in 1829. This was the line which really led the way to the immense development of the railway system now so familiar, though the Stockton and Darlington Railway, opened in 1825, was the pioneer undertaking of this kind. The following description of modern railways gives as full an account of their construction and working as is practicable within necessarily restricted limits.

The Permanent Way.—The 'permanent way', as it is called, consists of the finished roadway with the rails firmly laid and fixed for permanent use. As in the case of all roads, the first question to be considered is the use to which a railway is to be applied, and the weight on the wheels that are to run over it. The next consideration is that the road should be thoroughly well drained. The sleepers or substructure should be bedded on at least 12 inches in depth of porous stone or gravel, constituting the ballast, without any clay or other material in it that may make an impervious bed. In many places natural ballast is not to be had, and where clay exists the process of burning the clay is resorted to. The rails should be stiff both vertically and laterally, so that they should not yield either to the lurches of the engine and the train, or to the heavy loads carried on the wheels. In 1857 the substitution of steel for iron rails wrought a great change in railways, giving the rails about sixfold greater endurance in respect of wear, and a considerable increase in the power of resisting strains and jars.

The general appearance of the ordinary double line of rails—the *up line* and the *down line*—of an ordinary railway is shown in fig. 3, Plate II., in which the arrows indicate the reverse directions of the trains. Figs. 4 and 5 represent in plan and elevation a portion of two rails *a a*, resting on the cast-iron chairs *b b*, on the wood sleepers *c c*; the ends of the rails are united by two 'fish-plates' *d d*, placed one on each side, and bolted together. The rails are keyed in the chairs by the oak keys *e e*. Fig. 6 shows the sectional form of the rail. Figs. 7 and 8 indicate the method of gauging the rails and drilling the holes for the trenails or spikes to fasten down the chairs on the sleepers. Mr. Greaves' method of supporting the rails on cast-iron sleepers in the form of inverted pots is shown by fig. 9; this plan has been considerably used in Egypt and India, the material being more durable than timber. Fig. 10 shows a species of foot-rail in section. Fig. 11 shows the 'bridge-rail', known also as the Brunel rail, having been introduced by Mr. I. K. Brunel. Both these rails are fastened to the sleepers directly without chairs, as also is the flat-bottomed Vignoles

rail, a variant of the above, largely used on the European Continent and in America.

Gauge.—The 'gauge' or measure of a railway is taken as the distance apart of the inner sides of the upper surfaces of the two rails forming a line of rails or way. In England there used to be two principal gauges, known as the 'narrow' or 'standard' gauge, 4 feet 8½ inches wide, and the 'broad gauge', 7 feet between the rails. The 'narrow' is the national gauge of Great Britain. It was employed by the elder Stephenson for the Liverpool Railway, and thereupon adopted for other lines, with a few exceptions, the most important of which was the broad gauge, 7 feet, introduced by the younger Brunel on the Great Western Railway. The inconvenience of the 'break-of-gauge' at the junctions of the narrow and the broad gauges, particularly with respect to the cost and delay of transferring passengers and goods, came to be so serious that in 1892 the 7-foot gauge was finally abandoned throughout the whole of the Great Western system, the standard gauge superseding it. The other gauges (with a few unimportant exceptions) have also been reduced to a uniformity with the standard gauge. The gauge of railways in Ireland is uniformly 5 feet 3 inches, being 6½ inches wider than the English gauge, thus giving proportionately more room for the construction of the rolling stock. The European gauge is, for the most part, the same as the English; but the Spanish gauge is wider, being 5 feet 6 inches, thus constituting a 'break-of-gauge' with France, commercially inconvenient, but supposed to be politically expedient. The gauge of railways in India is also 5 feet 6 inches. The Russian gauge is almost exactly 5 feet. The American gauge is now almost invariably 4 feet 8½ inches. The English national or Stephenson's gauge is not nearly of sufficient width. With the large and steadily expanding traffic of modern times a continuous increase has been necessitated in the power of engines. This involves material enlargement of boilers and cylinders, and it is a grave drawback of the 4-foot-8½-inch gauge that its limitations seriously restrict the dimensional extensions which are needed to enable British locomotives to grapple with the duty imposed upon them. Probably the Irish gauge of 5 feet 3 inches would be found to afford all the requisite facilities, but it is hopeless to expect that any alteration in the national gauge can now be made. Some engineers, with a view to cheapness of construction, have built lines of still narrower gauges—3 feet 6 inches, 3 feet 3½ inches or 1 metre, 3 feet, and even 2 feet or less wide. The work which has been performed on such narrow gauges has been unexpectedly good, but it has been amply proved that the economy claimed for the narrower gauges has been overrated. In several of the British colonies a variety of gauge still exists. In Australia no fewer than three, namely, 5 feet 3 inches, 4 feet 8½ inches, and 3 feet 6 inches, not only exist, but are still used in the case of lines under construction or planned. Indeed, in one or two of the States of the Commonwealth two different gauges are maintained, with all the disadvantages of 'break-of-gauge'; and the restriction to one uniform gauge, which must ultimately be carried out, will be a matter of most formidable difficulty and cost. In the colony of New Zealand the three different gauges formerly existed, but all the New Zealand railways not already constructed on the 3-foot-6-inch gauge have been altered to that measure. The disadvantages of a too narrow gauge have already made themselves felt, however.

Route.—Engineers endeavour so to plan the works of a railway that the earth to be excavated from the hilly ground shall be as nearly as possible equal to

RAILWAYS.—I

Fig 1



Fig 2

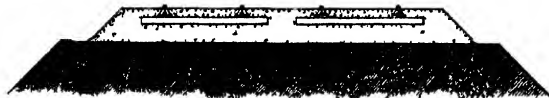


Fig 3

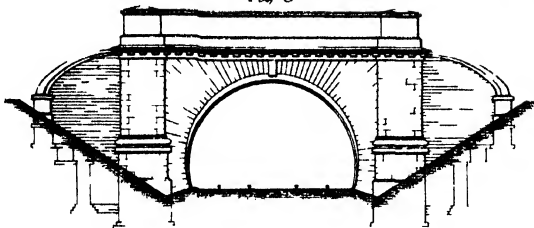


Fig 4

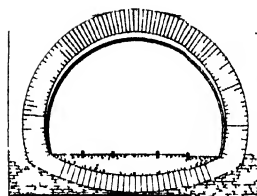


Fig 5

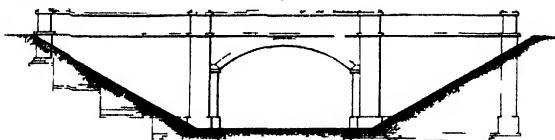


Fig 6

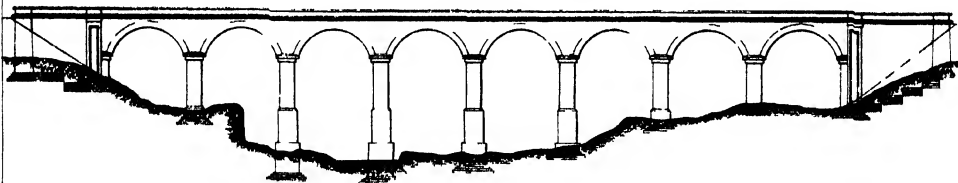


Fig 7

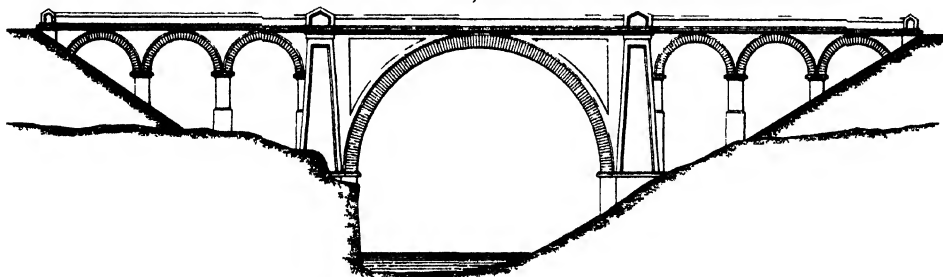
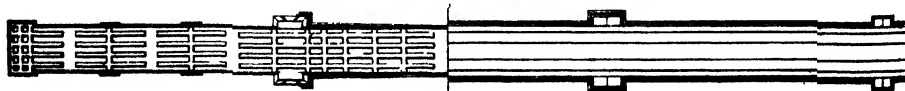
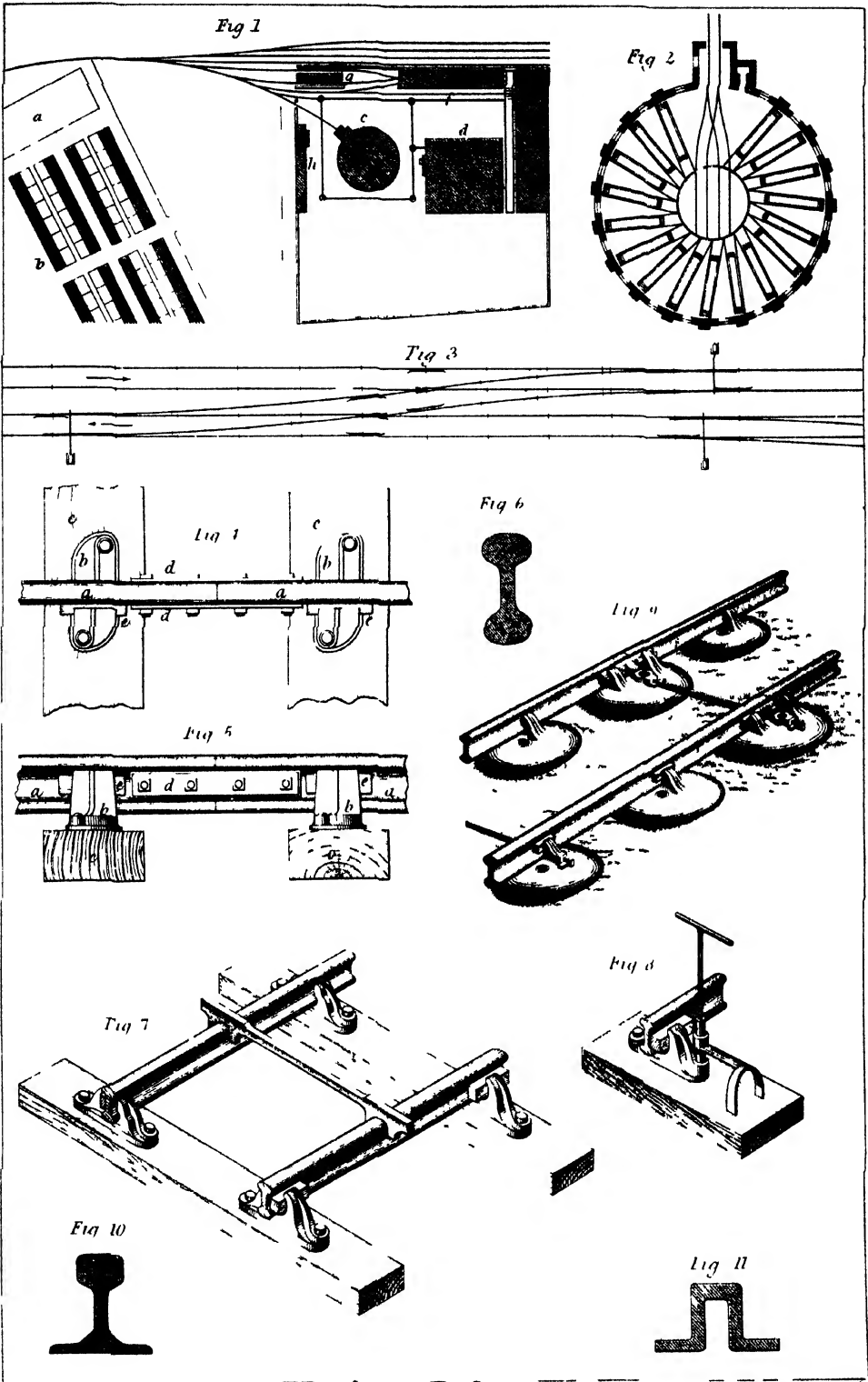


Fig 8



RAILWAYS.—II



the embankments in the valleys—effecting a redistribution of material rather than its removal, and arriving at the desired result by the simplest means and in the most economical manner. A straight and horizontal line is the standard of perfection; and the proper business of the engineer in laying out a railway is to harmonize the engineering and financial conditions of the problem so as to obtain the greatest return in proportion to the money expended; and to ensure that while the railway may be neither quite straight nor quite level, it should not be excessively costly in construction in order to be free from severe curves and steep gradients, or excessively cheap, making a heavy line involving high working expenses. There is a wise discretion to be exercised in laying out the route of a new railway, care being taken neither, on the one extreme, to divert it hither and thither to avoid every difficulty or embrace every eligible district on the route; nor, on the other extreme, to carry it with absolute directness.

Earthworks.—The earthworks of a railway are the foundation and support of the whole superstructure, and as such should be uniformly firm, and carefully considered with respect to material, preparation, form, and drainage; of liberal width, easy lateral slopes, ample ballast, thorough drainage. Fig. 1, Plate I. shows in transverse section the ordinary formation of a cutting in earth; the formation-level *a a*, 33 feet wide, is bounded by the side drains *b b*, for carrying off the rain-water or melted snow from the ballast. Beyond the side drains the slopes ascend to the natural surface of the ground at the rate of 1 foot rise to 2 feet horizontal, or, briefly, 1 to 2. Upon the formation-level the ballast *c c* is deposited 2 feet in depth, and about 23 feet wide at the top, being so wide, in fact, as to extend 4 feet on each side beyond the outermost rails. The sleepers and chairs are buried in the ballast; the rails also are partially covered with the ballast, with the exception of 2 or 3 inches which remain above the ballast, so that the rails may remain clear of gravel or other superficial obstructions, and have a clear way for the wheels. In some cases the upper surfaces of the sleepers are left exposed to the air. The total width of the cutting at the base *d d* is 42 feet. Embankments are the reverse of cuttings, being elevated above the surface of the ground, while cuttings are sunk below. They are, in general outline, according to fig. 2, being regulated by the same general dimensions as cuttings are. These dimensions are for the narrow-gauge lines. In each gauge a clear space, 6 feet wide, is allowed between the two pairs of rails. Cuttings are as deep as from 50 to 100 feet below the surface, but embankments are seldom so high above the surface, viaducts being preferred.

Tunnels.—It is often imagined that the cuttings of a railway when made through rock must have been very much more expensive than cuttings through clay. Their relative costs, however, do not greatly differ; for not only does the vertical rock-cutting require less excavation than the wide yawning earth-cutting of the same depth, with extended slopes, but when it is executed the rock-cutting is not liable to the expensive slips which sometimes overtake the other. It is usual to prefer cutting at any depth less than 60 feet below the surface of the ground; for greater depths it is generally cheaper to tunnel. The Kilsby tunnel, on the London and North-Western Railway, is 160 feet below the surface; it is 1 mile 3 yards long, 30 feet wide, and 30 feet high, and has two wide air-shafts, 60 feet in diameter, descending from the surface, to admit light as well as air, to enable the engine-drivers to see the rails from end to end of the tunnel. The tunnel

cost nearly £300,000, or £125 per yard running. The famous Box tunnel, on the Great Western Railway, was another difficult and expensive work, placed 70 feet below the surface; it is 1 mile 1467 yards long, and it has eleven air-shafts. The tunnel under the Mound, at Edinburgh, on the North British Railway, is formed circularly, 28 feet in diameter. Fig. 3, Plate I. is an elevation of one end of the tunnel, and fig. 4 is a section, showing the circular arch of the tunnel, built of brick, 3 feet in thickness, with the counterfort under-ground, on which the tunnel and its superincumbent load may be conceived to float—the Mound being, in fact, an accumulation of loose earth and rubbish deposited in the valley which separates the new town of Edinburgh from the old, on a boggy soil.

The longest English railway tunnel is the Severn tunnel, on the Great Western Railway, $4\frac{1}{2}$ miles long, passing under the bed of the Severn river from near Avonmouth to the Monmouth side. The next in length are the Totley tunnel on the Midland system, near Sheffield, 3 miles 950 yards; the Stand-edge tunnel on the London and North-Western, south-west of Huddersfield, 3 miles 62 yards; and the Woodhead tunnel on the Great Central—formerly Manchester, Sheffield, and Lincolnshire—between Sheffield and Manchester, which is 3 miles 17 yards long. The underground system of railways—such as the Metropolitan and the Metropolitan District Railways—which have been for a number of years in operation in London, exemplify a remarkable application of the tunnel.

Bridges and Viaducts.—The general appearance of an ordinary brick or stone bridge is represented by fig. 5, Plate I., showing a bridge over or under a railway. If across a cutting, over a railway, the foundations are laid in steps on the solid natural earth, as indicated by dotted lines on the left of the figure; if under the railway, in continuation of an embankment, the foundations are built up square from the solid ground, as indicated on the right of the figure. Many bridges have been built of timber and of cast-iron; but these materials—the former for want of durability, the latter on account of its brittleness and uncertainty—have generally been superseded by wrought-iron, forming plate-girder bridges. There are many stone viaducts of great length.

Among the earliest of wrought-iron railway bridges is the Britannia Bridge, connecting the island of Anglesey with the mainland of Wales. This bridge was designed by Mr. R. Stephenson to carry the Chester and Holyhead Railway across the Menai Straits, and is represented in Plate at article BRIDGE. It consists of two wrought-iron 'tubes'—literally rectangular boxes—with open ends laid side by side, through each of which the trains pass, on a line of rail laid on the floor of the tubes, at a clear height of 100 feet above high-water level. Each tube is 14 feet wide and 26 feet in height inside, at the central portion, and is 1513 feet in length. The total length of the bridge is 1842 feet. The Victoria Bridge crossing the St. Lawrence at Montreal, nearly 2 miles in length, was originally on the tubular principle. The girders of wrought-iron bridges are now often constructed of lattice-work, instead of continuous plates as in the bridges mentioned; and it is thought that in this method of construction equal strength is obtained with less material. Another type of bridge which has recently come into prominence is that constructed on the cantilever principle, the chief example of this and the greatest among all railway bridges, being the Forth Bridge. See FORTH BRIDGE, also BRIDGE.

Stations.—Stations are of many classes, although

they may be roughly divided into two main groups, 'terminal' and 'intermediate'. The vast aggregation of buildings which constitute a chief terminal station of a great line of railway consists primarily of three distinct departments:—1. The passenger station, appropriated to the embarkment and disembarkment of the passengers, and other objects of traffic, as small parcels and mails, which are carried by the same trains. 2. The goods station, which is appropriated to the reception and embarkment, and the disembarkment and discharge, of goods and live stock transmitted by railway. 3. The locomotive, carriage, and wagon depots, where the engines and the carrying stock repose, are cleaned, examined, and repaired. At many intermediate stations the same arrangements, on a smaller scale, are made; in all of them there is at least accommodation for the passenger and the goods traffic. The largest stations in the world are not to be found in its largest city, London, or indeed in Britain at all, 'Mother of Railways' though she be. Certain German and American stations are more extensive than anything this country can show. The London terminus of the Midland Railway at St. Pancras, and the Great Northern terminus at King's Cross—fine though they both are—rank low as regards size among the world's large stations. The Waverley Station of the North British Railway at Edinburgh—since its recent enlargement—and the New Street Joint Station of the London and North-Western and Midland lines at Birmingham are both more extensive than any London station. Among the metropolitan termini, that of the Great Eastern Railway at Liverpool Street, with no fewer than eighteen platforms, is by far the biggest, Waterloo (London and South-Western) and Euston (London and North-Western) coming next. The roof of St. Pancras Station is in a single span of 240 feet. As a matter of fact the passenger terminus may be described as 'all roof', there being no sides at all, the vast Gothic roof springing on each side from the level of the rails. Several of the French railway stations are remarkably fine architecturally, and excellently planned for practical purposes, notably the Paris terminus of the Northern Line; that of the Western Line in the Rue St. Lazare, also in Paris; and the Tours terminus of the Paris-Orleans Railway.

Noteworthy among intermediate stations are those at Nottingham (Victoria—Great Northern and Great Central joint), Rugby and Crewe (London and North-Western), Leicester (Midland), York and Newcastle (North-Eastern). The fine Citadel station at Carlisle accommodates no fewer than eight different railways, viz.: the London and North-Western, Midland, North-Eastern, Lancashire and Yorkshire, North British, Glasgow and South-Western, Caledonian, and Maryport Lines, and in this respect stands alone.

Large portions of the railways in the vicinity of London and other populous cities are laid with more than a double line of rails, triple and quadruple tracks being common. The principal sections of many of the chief British railways are now laid with quadruple lines. When many lines run into a station, and numerous sidings are required, the arrangement of the whole becomes complicated, and simplicity and facility of working have to be consulted to the utmost extent. For every traffic line both entering and leaving the station it is necessary to supply one or more sidings in addition to others specially allotted to brake-vans, horse-boxes, locomotives, &c. The platforms must be as roomy as possible, and the pillars or other structures supporting the roof as few as is consistent with stability.

Locomotive Stations.—Locomotive stations are generally situated at or near the principal terminus of the railway, sufficiently close to a large town to ensure facility for obtaining materials and workmen; and sufficiently far off to be clear of the heavy local taxes with which such establishments in all large towns are burdened. The locomotive station of the Great Central Railway is selected for illustration. It is situated at Gorton, about 2 miles from Manchester, the first position where the railway and the land take the same level. The total quantity of land purchased was nearly 20 acres, about 9 of which are occupied by the workshops and store-yard; the remainder is used for the construction of reservoirs for supplying the works with water, and for erecting cottages upon it for the work-people in the company's service. The block-plan (fig. 1, Plate II.) shows the general arrangement and relative positions of the shops, cottages, reservoirs, &c. The reservoirs *a* are supplied from the adjoining canal, the water passing through filter-beds in its course from the canal to the reservoirs. These reservoirs, from their elevated position, supply the water directly into the tenders upon the railway, and throughout the workshops, the canal being at a sufficiently high level to supply them. The cottages *b* are arranged in four blocks. The plan of the works is nearly square, the entrances being placed toward the cottages on the east side of the works, and adjoining are the offices and general stores *h*. The engine-house, or shed for engines on duty, *c*, is a rotunda of 150 feet in diameter inside, and is capable of holding seventeen engines with their tenders, leaving the entrance and exit lines clear. To the left of the entrance is a furnace for holding live fuel, from which the engines are lighted; and there are two lines of rails across the central turn-table (fig. 2), on one of which the engines enter, and on the other depart. To the left of the rotunda are the workshops, with stationary engine-house and boiler. The block *d* contains the fitting and tool shop, the smiths'-shop, the boiler-shop, and the erecting-shop. The carriage and wagon shops are in *e*, the wagons being on the ground-floor, and the carriages above, to which elevation they are raised by a self-acting worm-hoist, worked by the stationary engine. These shops are 320 feet by 70 feet, and can receive fifty wagons and thirty-eight carriages. Besides these buildings, there are in the block *f* a paint-shop and a shed for locomotives in reserve; also a coke-shed *g*, so constructed that the coke waggons stand on one side, whilst the locomotives approach and receive their charge of fuel on the other side, the coke being measured into baskets on the intervening platform.

Switches and Crossings.—The use of switches and crossings is to form a link of communication between one line of rails and another, of which many are required at and about railway-stations and at junctions. They are usually constructed with ordinary rails, and are carried on cast-iron chairs spiked down to sleepers. The switch-rails are movable, and are worked by rods, to which heavy weights are attached, the function of the weights being to retain the points in one position, and to act as a self-acting adjustment in restoring them to it—their normal position—after having been shifted for the passage of a train.

When only one of the terminal rails is movable, it is called a single switch, and is used only on sidings or branch lines of rail; the double switches, being more perfect in action, are adopted on the main line, and, as a general rule, switches on the main line are ordered to be laid with the points in the direction of the traffic, so that passing trains may run out of the points and not into them. 'Facing-points', as they are termed, are such as are laid on the main line

facing or pointing towards the regular advancing trains. Many accidents have been caused to trains by facing-points improperly set or out of order turning the train unexpectedly into a siding, with the impossibility of pulling up in time to prevent a collision, or throwing the train off the rails altogether, producing what is called 'derailment'. So dangerous are facing-points felt to be, particularly on high-speed lines, that on some railways they are absolutely forbidden at all except terminal stations, and at intermediate stations where every train is ordered to stop.

Turn-tables.—These are of two classes—for turning carriages and wagons, and for turning engines and tenders together. For the carrying stock they are sufficiently large to receive conveniently vehicles of which the wheels are 8 to 10 feet apart between the centres. Turn-tables ordinarily used are of iron or steel, carrying two transverse lines of rails, and revolve upon a central pivot and conical rollers near the circumference, which are upheld and turned upon a cast-iron base bedded in cement, or on a built foundation. For turning engines and tenders together, turn-tables fully 50 feet long are required, and when double-bogie tenders running on eight wheels are used still larger turn-tables are necessary. In some cases 'reversing triangles' are employed instead, the engine, by running along each side of a triangle and reversing at each angle, returns to its starting-point with its head in the direction desired.

Water-cranes, &c.—Water-cranes are erected at convenient spots for delivering water to the locomotives. Of these the upright column, containing the supply-pipe, and the horizontal member with the leathern hose attached to it to direct the current of water into the tender, are sufficiently familiar. The ingenious invention of the late Mr. John Ramsbottom, by which an engine at speed can pick up water from a trough between the rails by means of a scoop lowered from the tender, is coming more and more into use. Originally introduced on the London and North-Western, of which railway its inventor was the chief mechanical engineer, it was next adopted by that line's near neighbour, the Lancashire and Yorkshire, and is now in extensive use on the Great Western, Great Eastern, Great Northern, and North-Eastern Railways of England, as well as in the United States, while it has been decided to introduce it on the Northern Railway of France. By enabling water to be taken *in transitu*, not only is much time saved at stations, but also the weight of the tender can be reduced by some 20 tons, making a difference of a vehicle's weight in the train load.

Signals.—By common consent railway companies have arrived at the adoption of the semaphore signal for regulating the movements of trains; but the companies do not all work by the same code. One railway uses it to give two signals, and another to give three; a third will have an auxiliary or distant signal, placed at 500 or 600 yards from the station, to act as a repeating signal, others preferring to use it only as a caution. The semaphore is perfect in the simplicity of its form and its action, consisting of a plain flat board or 'arm', hinged on by one of its extremities to an elevated post or standard. To signal danger, or, in fact, to forbid the passage of an engine or train, the arm is turned straight out, at right angles to the post: when the line is free for the passage of the train the arm is turned down into a diagonal position at 45 degrees, or at a rather less angle with the post, or is dropped to a position vertical or nearly so. It is now universally agreed that the safest method of working the signals of a railway is what is called the *block system*, according to which an interval of space, namely, the distance

between two signal-boxes, is always kept between two trains on the same line. The signalman at one signal-box does not signal a train to pass until he has received intimation by telegraph that the previous train has passed the next box in advance. Other essential elements of security consist in a clear definition of the duties of the attendant to the signals, their strict enforcement, the selection of the most suitable men, paying them adequate remuneration, and providing them with convenient, warm, well-fitted 'cabins', with ample window-space, within which they may keep a constant watch over the line without exposure to weather. At junctions, where the signalman works the points in connection with the signals, his cabin or box is raised to some height above the level of the rails, to give him perfect supervision in every direction. A similar precaution is of service at all other important signal-stations, even where points may not be worked in connection with signals.

At night it is needful to supply the place of semaphores by large and powerful lamps, with reflectors, capable of showing lights of different colours. Usually a red light is used as the equivalent of the straight-out semaphore-arm, and a green of the inclined arm. They are changed either by revolving the lamp on its axis, to present a different side with a differently-coloured glass, or by retaining the lamp as a fixture and sliding differently-coloured glasses in front of the light. Formerly the white light was used as the 'line clear' signal, and the green as an intermediate or 'caution' signal. But usually of late years only the two, 'line clear' and 'line blocked'—popularly known as 'all right' and 'danger'—are employed. The white light as an 'all right' signal is now generally discarded, as it is apt to be confounded with ordinary lamps, and as the accidental breakage of a red glass might make a danger signal appear to show 'line clear'; the green light has the merit of being affirmative, and is therefore preferable.

Rolling-stock, Carriages, and Wagons.—For particulars regarding railway locomotives the reader is referred to the article under that title. The ordinary six-wheeled first-class carriages, technically termed 'couches', of the modern type are commonly 28 to 30 feet long, and are divided transversely into four compartments, each 7 to 7½ feet long and well-lined with cushions. In each compartment there are six seats. In some instances the seat-partitions or elbow-rests are dispensed with, and the whole width of the compartment is thrown open to receive four on each side, or thirty-two passengers in one carriage. Six-wheeled second-class carriages are usually divided into four or five compartments, holding eight or ten passengers each. They are now generally well-cushioned, and roomy and comfortable enough. Third-class carriages do not differ very much from second-class, except that on railways of an inferior order they are often uncushioned, and altogether less comfortable. The railway companies are now sensible of the magnitude and importance of third-class traffic, and the third-class carriage stock has recently been greatly improved, especially on the long through lines of traffic. The six-wheeled and four-wheeled passenger carriages are, however, rapidly becoming extinct in Great Britain excepting for short journeys and suburban traffic, when they are usually of the 'short-buffered' type. For main line work far larger and heavier and more convenient vehicles have come into extended use. The Great Northern Railway Company, for instance, introduced in 1891 third-class 'corridor carriages' (as shown on Plate III.), with a passage or corridor at one side for the whole length of the carriage, from which access is

given to each compartment. There are five compartments for passengers, and two lavatories, one at each end of the carriage. These carriages, however, have since been greatly improved upon, and their size has been increased. *Composite* carriages are those in which the other classes are conjoined. As regards weight and cost, carriages vary considerably. A twelve-wheeled composite bogie carriage of the Midland Railway, for instance, 54 feet long and carrying 58 passengers in eight compartments, weighs 23 tons. Carriages are now commonly lighted by gas, either coal-gas or oil-gas (the latter having been found very suitable), or by electricity.

In the United States the common type of carriage is of great length, and has a passage down the middle and seats on either side, the doors being at the ends. The conductor of a train of these cars can thus go from one end of it to the other. Such cars are supported on two bogies—four-wheeled or six-wheeled trucks, pivoted so as to be movable, and thus allow the car to take a sharp curve without danger. Passengers are generally of one class only, but those going for long distances can often engage a sleeping-car for an extra payment. The celebrated Pullman-car is one of this kind, being well known in Britain as well as in America. It is a luxuriously-fitted-up vehicle specially adapted for sleeping in, or as a drawing-room or dining-car, and is named after its inventor. It is of great length and mounted on bogies. The ordinary carriages in America are usually from 50 feet to 70 feet long; the passage down the middle is about 2 feet wide, having fourteen or more seats arranged crosswise on either side, each seating either one or two persons. The carriages are heated by a stove or by steam, and are lighted by oil or gas. The most recent tendency alike in Britain and on the European and American Continents has been to increase greatly the weight of passenger coaches in order to enhance the convenience of travellers, who are provided with luxurious restaurant cars by day and—in the case of first-class passengers—comfortable sleeping-berths for night travel. These often weigh from 30 to 40 tons, and in America even more. They constitute a great boon to travellers, but necessarily augment in a formidable degree the aggregate of 'dead'—i.e. non-paying—weight that the engines have to haul.

The wagon-stock employed in the conveyance of merchandise, minerals, and live stock is made as nearly uniform as possible. Uniformity in this class of rolling-stock is more important than that of carriages, as their total number and cost are much greater, and the supervision with which they are favoured is less minute; besides, the cost of maintenance is less than where many varieties of wagons exist on the same line. But whatever may be the upper works, the under works of the whole of the wagon-stock should be entirely uniform. One of the greatest engineering evils that have been inflicted upon railway companies has arisen from the want of arrangement or consultation between the officers of different lines, in order to consider the question, common to all, as to the best plan and construction of vehicles to be used by them. The result has been that several companies have built classes of stock unsuited to work conjointly the traffic of their own and other lines. The wagons at present in use are either covered or open: the open being for coals or other bulky goods not liable to be damaged by wind or weather; the covered, for goods that are liable to such accidents or are relatively much more valuable. There are also special wagons for live stock. There have been many improvements in wagons in recent years, more especially in the way of furnishing them

with buffing and drawing springs, so as to diminish risk of breakage to goods and injury to the wagon itself. They are usually constructed to carry from 6 to 10 tons of goods, but in America and elsewhere wagons are often of very much larger size, carrying from 40 to 50 tons, and are placed upon two four-wheeled bogies, thus conveying a far larger proportion of paying load to their dead-weight. This method has recently been adopted on the Caledonian Railway for its heavy mineral traffic, and its adoption is under consideration by some other British railways.

Extent of British Railways.—The rapidity with which railway communication has been extended may be estimated from the fact that in 1843 there were little more than 2000 miles of railway open in the United Kingdom, while now the total length open amounts to 21,855 miles. The number of miles added in 1890 was 130; in 1900, 155. The total length of railway open at the beginning of 1901 was distributed among the three sections of the United Kingdom as follows:—

England and Wales,.....	15,187 miles.
Scotland,	3,485 „
Ireland,	3,183 „
	<hr/>
	21,855 „

More than half of this consists of a double line of way; the rest consists of a single line of way. Considerable portions, however, of the lines have been tripled and quadrupled, while vast lengths of sidings have been laid down in most parts of the United Kingdom. The railways belong to about 300 companies, but as many of the smaller lines are leased to or worked by larger lines, the number of working companies is not much more than a third of that number. The greatest mileage worked by any one company is that of the Great Western Railway, which works 2655 miles. There are some very short lines, however, only a few miles in length, which continue to be worked and owned as independent undertakings.

Capital of Railways.—The total amount of capital raised for the construction of British railways was in 1900 no less than £1,176,001,890 sterling, of which there was raised:—

For English Railways,	£970,147,581
„ Scottish Railways,	166,088,736
„ Irish Railways,	39,765,573
	<hr/>
„ United Kingdom,.....	£1,176,001,890

This total represents a cost at the rate of about £53,000 per mile open.

Overhead and other Railways.—A system of overhead railways exists in New York, the lines running through the streets of the city, and the tracks of rail and trains being supported on iron pillars at a height of some 20 feet or more above the ground. These pillars are of wrought-iron lattice-work, and sometimes there is a row of them on either side of the street, sometimes two rows in the middle supporting the girders on which the rails are laid.

Another variety of railway is that known as the 'rack' railway, adopted when steep ascents have to be climbed, there being a rack-rail laid along the middle of the track, having indentations or teeth in which the teeth of a wheel fixed to and driven by the engine engage. The well-known railways up the Rigi in Switzerland are of this class. On the first built of these the gradients average about 1 in 4½. Another railway of this kind is that up Pike's Peak, Colorado. In what is known as the Lartigue system there is but one rail, elevated 3 or 4 feet, across

which the carriages are, as it were, set astride. In the Fell system of mountain railway there are three rails, the middle one, which stands higher than the others, being gripped on each side by horizontal driving-wheels which are pressed against it strongly by powerful springs. On the two side rails vertical driving wheels rest in the usual way and exercise tractive force by means of the engine's adhesion weight. This system is employed on the Mont Cenis line in Europe, and on the Rimutaka Incline in New Zealand.

Light Railways.—The Light Railways Act of 1896 provided for the construction, where desirable, of railways on the national standard gauge, 4 ft. 8½ in., but of a lighter and cheaper form of construction, intended to act as feeders to the regular lines by running through parts of the country where it would not pay to build railways in accordance with the numerous requirements of the Board of Trade. These railways are worked at lower speed, and the restrictions imposed on the ordinary lines are materially relaxed as not being necessitated in the interests of public safety by the conditions of working. In sparsely-peopled agricultural districts these light railways have proved highly beneficial, and they have been of service to the regular lines by bringing traffic which otherwise might not have accrued.

Passenger Traffic.—According to the official returns the total number of passengers conveyed on the railways of the United Kingdom during the year 1900 was 1,142,276,686. This would be equivalent to about twenty-seven journeys per head for every man, woman, and child in the whole population of Great Britain and Ireland, which by the last census amounts to about 40 million persons. In this computation, however, the season-ticket holders are not included. As illustrating the remarkable increase of passenger traffic during the second half of the nineteenth century, it may be interesting to quote the respective numbers of passengers conveyed in the year 1850, and in each tenth year thereafter. These are shown in the following table, as also the number of miles open for traffic in each of those years:—

Year	Length of Line open for Traffic	Total Number of Passengers carried (exclusive of Season-ticket Holders)	
		Miles	No
1850	6,621	72,854,422	
1860	10,433	103,435,678	
1870	15,537	336,545,397	
1880	17,933	603,895,025	
1890	20,073	817,744,046	
1900	21,855	1,142,276,686	

It has been mentioned that these totals do not include the number of season-ticket holders, of whom in the year 1900 there were no fewer than 1,749,804. It may fairly be calculated that these season-ticket holders, who, as a rule, are people travelling to and from their business on six days in the week, may be credited with at least five double journeys per week on the average. That would be equivalent to ten single journeys per week, or about 500 per annum. If then this mode of computation be applied to the whole number of season-ticket holders, it would increase the total number of 'passengers', by which is meant individual journeys made during the year, by more than 500,000,000.

By far the larger proportion of the vast increase in passenger traffic shown during the past thirty years has been in the case of the third-class passengers, for whom, year by year, continually-improved facilities and conveniences have been afforded. A comparative statement is appended of the respective particulars of first, second, and third-class passengers—exclusive of season-ticket holders—conveyed in the years 1870 and 1900:—

VOL. XI.

	1870.	1900.
First Class,	31,839,091	34,518,909 passengers.
Second Class, ..	74,153,118	69,084,629
Third Class,	224,012,194	1,088,873,848
	330,004,398	1,142,276,686

It will be observed that the number of first-class passengers shows a relatively small increase. Even this, however, has not been continuous during the period, for in 1890 the number was 30,187,067, which shows an actual decrease of nearly 1½ million as compared with that of 1870, a period of twenty years; whereas the return for 1900 displays an increase of more than 4 million passengers compared with 1890, that is to say, in the final decade of the nineteenth century. The explanation is probably to be found in the fact of the special inducements offered to travellers to use the higher class vehicles, e.g. the breakfast, luncheon and dining cars, sleeping cars, Pullman and drawing-room cars, &c., the extension of dining-car privileges to second and third-class passengers having been but very recently accorded.

In the case of second-class passengers there was a decrease of more than 5 millions in the thirty years, but in this case the experience just mentioned with regard to first-class passengers was repeated in an accentuated form. For whereas the second-class passengers show a decrease in round numbers of 5 millions since the year 1870, they exhibit an increase of more than 6 millions as compared with 1890, when their number was 62,859,854. In this case also the explanation may be found in the special circumstances. In the first place, the diminution in the number of second-class passengers is naturally accounted for by the fact that the second-class has been abolished for a quarter of a century over the whole vast system of the Midland Railway, also for a number of years over the greater portion of the Great Northern, Great Eastern, Great Central, North-Eastern, Caledonian, North British, and other leading British lines, as well as between England and Scotland by the London and North-Western. Early in the 'nineties' the second-class appeared within measurable distance of total extinction in the United Kingdom, excepting perhaps in the case of urban and suburban traffic. But several of the principal railways resolved to try if it were possible, by greatly lowering the second-class fares, to induce passengers to travel by that class in order to secure certain accruing advantages, notably a more select type of fellow-passengers. The result appears to have fulfilled the expectation of those who originated the idea, and the outcome may be seen in the fact shown above, that whereas the second-class passengers decreased by 11 millions in the twenty years 1870–1890, they increased by more than 6 millions in the ten years 1890–1900.

Little needs to be said in explanation of the gigantic increase in the number of third-class travellers, an increase of more than four-fold in the thirty years, and of more than 30 per cent in the decade. The fact that anybody who desires it can travel by all the best expresses in the kingdom at a maximum rate of one penny per mile, and often for considerably less, is quite sufficient, when added to the natural increase of the population and of the public tendency to travel, stimulated as it is by the enhanced facilities afforded, to account for the prodigious development in this section of the traffic. It may be added that by the end of the nineteenth century every restriction in the way of travel had been removed, third-class being run on every train, except in the case of the three South of England railways, which enjoy the unfortunate reputation of being the slowest of any, namely: the London,

Brighton, and South Coast; the South-Eastern; and the London, Chatham, and Dover. These last two are now amalgamated as the 'South-Eastern and Chatham', which, it may also be noted, is absolutely the sole railway system in Great Britain to continue the antiquated method of charging extra fares by its express trains.

The total receipts from passenger fares on the railways of the United Kingdom in 1900 amounted to £38,086,595. To this has to be added £6,230,702 for carriage of excess luggage, parcels, carriages, horses, dogs, &c., and £1,066,691 for conveyance of mails. This brings up the total receipts from all classes of passenger traffic to the sum of £45,383,988.

Goods Traffic.—During the year 1900 the goods traffic on the railways of Great Britain and Ireland totalled 424,929,513 tons. This may be broadly divided into two main classes: minerals (principally coal) and general merchandise, the respective totals being 306,389,083 tons and 118,540,430 tons. The total goods traffic during the year on the railways of England and Wales amounted to 359,524,742 tons, and the receipts to £45,339,962; on the Scottish railways to 60,233,461 tons, and the receipts to £6,431,693; on the Irish lines to 5,151,810 tons, and £1,698,909. The gross receipts from all classes of goods traffic on British and Irish railways in 1900 amounted to £53,470,564 as compared with £50,650,000 in 1890, and with £24,000,000 in 1870.

It will be observed that the whole receipts from goods traffic exceeded those from the passenger traffic by more than eight million pounds sterling, whereas in 1890 the excess was more than double this amount. This manifestly indicates a tendency on the part of passenger traffic to grow in respect of its receipts at a faster proportionate rate than the goods traffic. It will be borne in mind that the original purpose for which railways were designed was to carry goods, but for many years past the tendency has been to give every possible preference to passenger traffic, which accordingly has expanded proportionately to the facilities afforded. The total gross receipts from all sources of railway traffic in the United Kingdom during 1900, including rents, tolls, steamers, &c., amounted to the stupendous sum of £104,801,858.

Working Expenses.—It is needless to say that the earning of this enormous revenue involves a very large outlay in respect of working expenses. These are not only vast in themselves, but also have unfortunately exhibited a tendency to increase steadily in their ratio to the gross receipts. Thus, whereas in the year 1860 the working expenses absorbed only 47 per cent of the total receipts; those of the year 1900 swallowed up no less than 62 per cent of the revenue, leaving only 38 per cent of the gross amount as net profit instead of 53 per cent as in 1860. A disquieting feature in this tendency to increase is to be found in the fact, that whereas the rate of increase proportionately to revenue was only 1 per cent in the ten years 1860–1870, and only 3 per cent in each of the two following decades, 1870–1880 and 1880–1890, the expansion during the ten years 1890–1900 was no less than 8 per cent. The explanation of this formidable enlargement of expenditure is to be found in several different directions. In the first place, there has been a large and persistent rise in the rate of wages; secondly, there has been, very properly, a material limitation in the number of hours that the employés work, this being mainly due to the initiative of the Board of Trade; thirdly, the cost of coal has risen considerably, and occasionally has reached an exceptionally high rate; fourthly, most of the other materials required for railway purposes have had a tendency to become

dearer; and, further, the restrictions, very rightly enforced by the Board of Trade, the additional facilities required to be given for the transit of workers to and from their employment, and the numerous other extensions of protective appliances, including continuous brakes—automatic and otherwise—signalling, interlocking of points, &c., have all tended in the same direction.

It is a moot point, and one that is undergoing most earnest consideration at the present time, and upon which extensive investigations and experiments have long been proceeding, whether it be not possible, by extensive reconstruction of British methods and systems, to work the various classes of traffic with greater efficiency and a smaller cost. Several leading railways have despatched observation parties of their chief officials to the United States with the object of carefully observing the means by which the American railways appear to be able in certain respects to carry on their traffic more advantageously in proportion to the amount of work done. Already there are symptoms of drastic alterations being in contemplation with regard to many matters of departmental detail. Apart from the substantial augmentation of locomotive power (referred to in the article *LOCOMOTIVE*) by enlarging the boilers, increasing the steam pressure, enhancing the tractive force by increasing the adhesion weight through the multiplication of coupled wheels, using various devices for the improvement of steam-generation (such as the water-tube firebox) and for the more economical use of the steam (as by compounding)—wagons are being constructed on the American system, of dimensions so large that they will carry a greatly increased weight of paying freight in proportion to their tare or dead weight. The Caledonian Railway was the pioneer in this last direction with its coal-wagons, introduced by Mr. J. F. McIntosh, which weigh 40 to 50 tons loaded, and run upon eight wheels disposed in 2 four-wheeled bogies. The same eminent engineer has brought out a new type of engine for the mineral traffic which is by far the largest and most powerful goods-engine yet adopted in Great Britain, and which will haul trains exactly double the weight of those pulled by the older Caledonian engines, previously the most powerful of their class. It may be added also that Mr. F. W. Webb, on the London and North-Western Railway, employs engines for similar duty which combine almost all the modern advantages mentioned above, having not only an additional pair of coupled wheels (eight in all) and higher steam-pressure—175 lbs. instead of 150 or 160 lbs.—but being also on the compound principle, and therefore theoretically economical in the consumption of steam and consequently of fuel. Similarly with respect to the passenger traffic, the tendency has been to provide much more powerful engines than those which were in use early in the 'nineties', the result being to diminish the frequency with which assistant engines or 'pilots' are employed, a practice which toward the close of the nineteenth century had become a grave reproach to British engineers, being almost unknown on the Continents of Europe or America, save only in circumstances of rare and exceptional difficulty. British locomotive engineers appear to have been somewhat tardy in realizing the fact that they were behind most other nations in respect of economical working; but, fortunately, since the fact has been realized strenuous exertions have been used, and are still in progress, to make up for lost time, and vast numbers of locomotives enormously more powerful than those previously in use have been lately brought out.

An analysis of the manner in which the working expenses are made up shows that considerably more than one-third of the whole is absorbed in providing and maintaining locomotive power and rolling-stock, including repairs and renewals. Traffic and general expenses accounted for almost exactly one-third of the whole in 1900. Rates, taxes, and government duty ran away with more than four millions in the year, amounting to nearly half the cost of maintaining the permanent way, bridges, tunnels, stations, and other works. The compensation to persons injured amounted in 1900 to £855,725; but this included over £146,000 paid to workmen under the Compensation Act of 1897. The following table shows in detail the manner in which the various branches of expenditure are distributed:—

Locomotive power, carriages and wagons, including repairs and renewals,	£24,461,834
Traffic and general expenses,	21,808,068
Maintenance of permanent way, works, &c., . . .	9,540,554
Rates, taxes, and duty,	4,087,697
Steamers, harbours, canals, and miscellaneous, .	3,031,524
Compensation to persons injured,	855,725
Legal and parliamentary expenses,	806,083
Miscellaneous expenses,	652,035
Total,	£64,743,520

Deducting the total working expenditure from the total gross receipts, a net profit is left of £40,058,338. This yields a net profit of only 3·41 per cent on the paid-up capital, which at the 1st January, 1901, amounted to the stupendous sum of £1,176,001,890. Just as the working expenses persistently increased during the last thirty years of the nineteenth century, so did the percentage of net profits as continuously decrease decade by decade. Thus, whereas the net profits in 1870 were at the rate of 4·41 per cent on the paid-up capital, in 1880 4·38 per cent, in 1890 4·10 per cent, the net profits in 1900, as already stated, were only 3·41 per cent. It should be added, however, that this decrease has been by no means uniform either in its rate or in its distribution among the various railways, for some favoured lines under particularly propitious conditions have paid dividends of 7 to 8 per cent, whereas others, under stress of ill-fortune, have paid none at all.

Railway Mileage.—In view of the fact that the needs of the British Isles in respect of railway reticulation are now to a great extent supplied, it is obvious that the expansion of mileage open cannot be expected to continue at the same rate as that at which it proceeded while the main traffic lines of the kingdom were still incomplete and in course of construction. In 1850 the total length of railways open in the United Kingdom was 6621 miles; in 1860 this had increased to 10,433 miles; in 1870 to 15,537; in 1880 to 17,933; in 1890 to 20,073; and in 1900 to 21,855 miles.

Traffic Development.—It may be interesting to summarize the principal points brought out in the foregoing observations. The following table shows the development of railway traffic in the United Kingdom. It is summarized from the Railway Year Book at the close of each of the past five decades:—

Year.	Total Capital Paid up.	Gross Receipts.	Working Expenses.	Percentage of Working Expenditure to Gross Receipts.	Percentage of Net Receipts to Total Paid-up Capital.
	£	£	£		
1850	240,270,745	13,304,669	—	—	—
1860	348,130,127	27,766,622	13,187,368	47	4·19
1870	529,908,673	45,078,143	21,715,625	48	4·41
1880	728,312,348	65,491,625	33,601,124	51	4·38
1890	897,472,026	79,948,702	43,188,666	53	4·02
1900	1,176,001,890	104,901,868	64,743,520	62	3·41

Railway Speeds and Performances.—Many attempts have been made to arrive at some definite standard of knowledge with regard to the actual power exercisable by locomotives of given dimensions, and numerous formulæ have been compiled on the basis of results obtained by direct experiment. These have embraced both the tractive power which an engine can put forth and the resistance of various kinds which it has to overcome in hauling a given load at specified speeds on a road with various gradients and curves and under different conditions of weather, &c. It must be confessed, however, that these are only trustworthy in a limited degree, and cannot be accepted as more than empirical approximations. Many pet theories and formulæ of the earlier railway engineers have in late years been ruthlessly demolished or at the least seriously discredited by the results of actual experience. For instance, it was theoretically assumed some thirty years ago that for an express engine to be able to draw a load of 150 tons behind the tender at the rate of 60 miles an hour, i.e. at a mile a minute, or 88 feet per second, it must have 100 lbs. of tractive force for every lb. of effective steam pressure in the cylinders, that is to say on the pistons. This tractive force was deduced from the following formula:—

$$\frac{d^3 \times L}{D} = T,$$

d being the cylinder diameter; L , the length of piston stroke; D , diameter of driving-wheels, all in inches; and T , the tractive force required. Thus, supposing a locomotive to have 18-in. cylinders, 26-in. piston stroke, and 6-feet-6-in. driving-wheels—dimensions very commonly met with—the result would be:

$$\frac{18^2 \times 26}{78} = 108;$$

and if the effective steam pressure on the piston—as distinguished from that in the boiler, which would necessarily be much higher—were 100 lbs., then the total tractive force indicated would be 10,800 lbs. But practical experience soon made it clear that a well-designed and suitably-proportioned locomotive possessing less than 100 lbs. of tractive force for every pound of steam pressure in the cylinders could easily haul 150 tons on the level at the rate of 88 feet per second. Far more than this has in fact been accomplished by engines having a tractive force of only 85 to 95 lbs. per pound of steam pressure on the pistons. For instance, Great Northern engines with single driving-wheels 7 ft. 6 in. in diameter and cylinders 18 in. x 26 in., thus possessing only 93 lbs. of relative tractive force, have hauled not merely 150 tons, but 250 tons, on the level at the rate of 60 miles an hour. But as a matter of fact most extant formulæ as to locomotive power and train resistance need complete re-examination and re-statement. According to tables compiled many years ago by Mr. D. K. Clark, the eminent engineer, an engine which could pull 290 tons at 20 miles an hour on the level, would be able to take 220 tons at 30 miles an hour, 160 tons at 40, 115 tons at 50, 85 tons at 60, and only 60 tons at 70 miles an hour; while as to the influence of adverse gradients, Mr. Clark computed that if a locomotive could draw 420 tons at 20 miles an hour on the dead level, it would be able to take at the same speed 340 tons up 1 in 600, 270 tons up 1 in 300, 200 tons up 1 in 150, 150 tons up 1 in 100, 120 tons up 1 in 75, 90 tons up 1 in 50, 45 tons up 1 in 30, and nothing beyond its own weight up 1 in 10. These formulæ have long been implicitly accepted by many engineers, but more recent experience has suggested many doubts as to their trustworthiness.

Unfortunately they have not been yet replaced by any that can be definitely accepted as final. Engines of identical power, but differing in respect of design, arrangement, and locality of construction, often vary to a most remarkable extent with regard to the actual practical power they are able to exercise. The force exercised by a locomotive is very commonly expressed like that of modern steamers' engines, in horse-power, and many comparisons have been made and formulæ deduced on that basis. But it cannot be regarded as more than a rough approximation to practical accuracy so far as concerns the engine's capacity for work. Not long ago some exceptionally careful and extensive experiments were instituted in this respect, with the disheartening outcome that not only did engines exerting nominally identical horse-power differ considerably among themselves as to the actual effective work they performed, but also in some cases engines which developed the less horse-power were able to do the greater work. In view of such a result it is difficult to attach any large practical value to calculations that are purely theoretical.

Much the same may be said with regard to the resistances which have to be faced, and to a more or less extent overcome, by an engine. Here again Mr. D. K. Clark supplied a formula which for many years was treated as axiomatic, but which recently has been not only challenged but in some cases seriously discredited. Experiments conducted by Mr. J. A. F. Aspinall, chief mechanical engineer of the Lancashire and Yorkshire Railway, by Monsieur du Bousquet, chief mechanical engineer of the Northern Railway of France, and other eminent engineers, have suggested considerable modifications in the formerly-accepted theories of train resistance at various speeds. Comparing the results of Mr. D. K. Clark's formula as worked out in practice with those obtained respectively by Monsieur du Bousquet and by an American engineer (Mr. Barnes), Mr. Aspinall came to the conclusion, as stated by himself, that 'Clark's and du Bousquet's figures are too high, but that those of Barnes are too low'. Mr. Clark obtained his theoretical train resistance by the formula:

$$V^2 \div 171 + 8.$$

But this, as applied to known performances of engines, has proved them virtually impossible. It has now been learned by empirical and practical experience that the resistance of trains does not increase with augmenting speeds to anything near the extent that was formerly supposed, and that under some conditions it even diminished with acceleration of velocity. But the whole subject is greatly in need of more thorough investigation.

One principal factor of resistance, on the other hand, is sufficiently well known, namely, that of ascending gradients. Owing to the greater ease with which the more powerful engines used in modern times can ascend steep inclines, much heavier grades have been freely used of late years than were deemed desirable or even feasible in the earlier days of railways. Thus, for example, the Great Western main line from London to Penzance has, in passing through South Devon and Cornwall, gradients as steep as 1 in 40, 1 in 41, 1 in 43, and many miles at 1 in 55, 1 in 58, and 1 in 60. Yet express trains run over these grades. The new short-cut from Aviemore to Culloden, on the Highland line, forming part of the main traffic route between London and Inverness, has ruling grades as steep as 1 in 60. The London and South-Western main line between London and Plymouth crosses Dartmoor by ruling grades of about 1 in 73. The

North British main line from Edinburgh to Carlisle has a rise at 1 in 70 for nearly 10 miles on end. The West Coast route from London to Glasgow and Edinburgh has an ascent at 1 in 75 of $4\frac{1}{2}$ miles near Shap, and for 6 miles to Beattock Summit. It is manifest that such steep grades can only be worked by a large increment of locomotive power. Thus, where the steep section is concentrated on one point, as on Beattock, an assistant engine is easily connected at the foot and employed to assist in the rear of the train by pushing it to the summit. Where the steep gradients are scattered over a considerable length, a second engine is usually attached in front and runs from terminus to terminus. This method, however, is open to many objections, particularly on the score of expense and inconvenience, and on some railways is absolutely prohibited. The prevalent tendency is in Britain, as it long has been on the European and American Continents, to augment the power of individual locomotives to such an extent as to enable them to grapple with all train loads that are in other respects feasible.

Speeds of Trains.—Although as regards the actual maximum speeds at which our trains can and are run, and the highest rate at which they are booked from start to stop, there has been comparatively little advance in more than half a century, there is an enormous increase alike in the number of fast-timed trains and in the weight of such trains. So long ago as the year 1848 trains were booked on the Great Western Railway at an average rate of over 56 miles an hour, and in 1902 there was only one train in England proper booked at such a speed, although there were two on the Caledonian Railway of Scotland, and many in France and America. But whereas the load hauled by the Great Western expresses in 1848 was only about 50 tons behind the tender, modern expresses timed to run between stations at speeds of 55 miles an hour, or more, accomplish this with trains weighing 300 tons and upward. Also, while in 1848 only one railway in the world, the Great Western, showed any such booked speed, and had only one train run daily timed so fast, there are in 1902 hundreds of runs booked at over 50 miles an hour, and most of these runs have to be done with heavy loads of 200 to 300 tons, and often more. Further, the inclusive rates of travel, that is to say, the average rates between termini, including all the time spent in stoppages at stations, have enormously increased. Speeds indeed have not been curtailed, but in many cases enlarged owing to the exigencies of traffic. But whereas half a century ago the usual course was for the first run out of London, and in some cases that of the next one, to be fast-timed, while the rest of the journey onward was booked at a comparatively low speed, at the present day the high average is maintained to the end of the journey unless there should be any special impediment, such as the excessive gradients of the Highlands or Cornwall, and by this means it has proved possible so largely to accelerate the average travelling rate of the trains. Even stopping trains are now in many instances booked at an average rate faster than that of many so-called expresses of fifty years ago.

Moreover, at the present day all the best expresses in Britain carry third-class passengers, who, being allowed to use the swiftest and most comfortable trains instead of being confined to very slow stopping trains, run at the most convenient hours possible, have taken more and more to travelling until they have become the mainstay of every British line.

Goods trains are usually run at an average inclusive rate of from 10 to 20 miles an hour according

to circumstances. This involves an actual travelling speed of about 20 to 30 miles an hour, and in the case of important express goods trains speeds of 35 to 45 miles an hour are not infrequently attained. Some special goods trains, particularly those conveying fish or other perishable freight to market, are drawn by passenger express engines, and are run at still higher speeds, falling little short of those maintained by fast passenger trains. Goods traffic is worked so far as possible during the night, and on those lines which have to carry much suburban traffic, goods trains are kept off so far as possible in what are considered the periods of 'business' traffic, viz. between 8 and 10 a.m., and between 4 and 7 p.m.

Some of the London terminal stations accommodate an extent of passenger traffic which appears phenomenal, and would be incredible were the facts not verified by conclusive statistics. Thus, for example, the Liverpool Street station of the Great Eastern Railway, and the Waterloo station of the London and South-Western, frequently have to deal with more than 1000 trains per day, and in the case of Liverpool Street, which possesses no fewer than eighteen separate platforms, the number sometimes exceeds 1100, the suburban trains usually consisting of fifteen or sixteen coaches generally filled to the utmost extent of their sitting accommodation, and sometimes considerably in excess of that limit, many passengers having to stand. The practice often seen on the Continent of using 'two-decker' vehicles for suburban service has not found favour in the United Kingdom.

Train Mileage.—In the year 1900 the total train mileage run in the United Kingdom was as follows:—

England and Wales, . . .	330,178,027
Scotland, . . .	48,618,281
Ireland, . . .	17,268,796
Total, . . .	402,065,104

In 1890 the total train mileage for the United Kingdom was 313,465,000. The increase during the decade was therefore very nearly 25 per cent. This was done in 1900 with the following rolling-stock:—

	Locomotives	Vehicles
England and Wales, . . .	18,040	590,032
Scotland, . . .	2,345	157,225
Ireland, . . .	810	21,900
Total, . . .	21,195	775,217

In 1890 the total number of locomotives at work in the United Kingdom was 16,237, and of vehicles 591,459. Here again the increase in ten years has been very large, more than 25 per cent.

Safety Appliances.—Notwithstanding the large extent to which railways are operated by mechanical means, the successful working of the traffic must necessarily be dependent for its safety upon the thorough efficiency, intelligence, and assiduity of the personal staff. Under modern arrangements almost all reasonable precautions in a general way have been taken to ensure the safety of travellers, although much still remains to be done in the interests of those employed on the lines. Under this heading must be prominently mentioned some adequate system of automatic couplings which will obviate the need of railway servants passing between vehicles, often in motion, for the purpose of coupling or uncoupling one from another. It is true that the use of poles, by which the operation can be performed more or less clumsily without stepping between the vehicles, has done a great deal to reduce the risk incurred, but has by no means eliminated it. In the United States of America and on the Anglo-Scottish

East Coast service of Great Britain certain systems of automatic coupling have been introduced and used with apparent success, but strenuous efforts have for some time been in progress to induce the Legislature to render the adoption of some such appliance compulsory.

So far as passengers are concerned, their safety has been largely promoted by the adoption of the block system on the one hand, and of automatic continuous brakes on the other. Under the old system of signalling a time-limit was allowed after a train had passed a signal post, the semaphore arm being successively lowered half-way in five minutes as indicating 'caution', and later dropped to a vertical position, which indicated that the next train might pass at full speed. It is obvious that this took no account of the possibility that a train might have broken down before reaching the next signal. And this defective method was the fertile cause of many fatal accidents. The block system, already described, is in all respects the reverse of this. Occasionally the blocking is extended over two lengths, for the sake of greater security. By the block system a train is absolutely forbidden to pass from one block length into another until the latter shall have been expressly reported clear. But there would be little use in forbidding the passage of a train unless those in charge of it possessed the means of stopping or checking it when required. Formerly the brakes, which are blocks of iron or wood mechanically pressed against the circumference of the wheels, were applied only to the wheels of the engine or tender by the driver and fireman, and to those of the brake-vans by the respective guards; and heavy trains running at high speeds on falling gradients often required a mile or more to be brought to a stand-still.

Under the regulations of the present day, passenger trains are required to be fitted with continuous brakes, which can be applied by the engine-driver or either guard to virtually every wheel in the whole length of the train; while the best of these are made automatic, that is to say, the breaking of any connection throughout the train has the effect of instantly bringing on the brake with its full power, thus stopping the train in a comparatively short distance. Numerous devices have been invented and tried with the object of attaining this end, but at the present day the alternative systems have been for all practical purposes reduced to two, namely, the Westinghouse brake, which works by means of direct air-pressure produced by a pump on the engine driven by its steam, and the Vacuum brake, which is applied by means of the natural pressure of the atmosphere evoked through the production of a vacuum by means of an ejector, also worked on the engine. Each method has its numerous votaries. The Vacuum brake, which, like the Westinghouse, acts automatically if required, is in larger use than the other in the United Kingdom, although the Westinghouse predominates in Scotland. On the European and American Continents the Westinghouse is in greater favour. It is claimed for the Vacuum that it is simpler in its apparatus, and therefore less liable to get out of order; for the Westinghouse, that it is more trustworthy, and is quicker in operation. It may be observed that the utmost a brake can do is to 'skid' all the wheels of a train, that is to say, fix them so that they cannot revolve. But this does not give the maximum power of retardation which is gained just at the moment prior to actual 'skidding'. Care is, however, taken so to regulate the brake that it shall attain this maximum retarding effect and shall not absolutely 'skid' the wheels, which, in addition to being a less effective method, has the drawback of heating the

portion of the wheel which slides along the rail, and of creating flat places by means of the friction and attrition. As, therefore, both plans may be deemed equally efficacious when actually brought into full force, the question of relative merit as between the two lies in the respective quickness with which they can be brought into full effect. So far as can be ascertained from the result of numerous trials, the latest modification of the Westinghouse brake appears to possess some superiority in this particular.

Reverting to the question of signalling, it may be observed that on some of the principal railways in the United States an automatic method exists by which the trains virtually operate their own signals; that is to say, when a train enters a 'block' it electrically sends up the danger signal, which remains against any following train until the first train has crossed into the next block, when the signal is automatically lowered. This plan appears to work with complete success, and it assuredly enables a far larger amount of traffic to be carried over a given length of railways than can otherwise be safely manipulated. The British system of signalling in case of fogs, although at the present day it is carried out with such care and efficiency that fog accidents are comparatively rare, nevertheless continues to be of a distinctly crude and rough-and-ready order. The ordinary signals, when invisible through fog, are supplemented by detonators placed upon the rails by fog-men specially employed on these occasions, the detonators being exploded by the leading wheels of the engine. By means of this singularly primitive plan the vast amount of London suburban traffic is ordinarily worked with relatively small delay. But it is much to be desired that a superior plan should be introduced which would enable some more explicit communication to be made to the engine-driver than can be conveyed through the explosions of detonators, and various suggestions in this direction are under consideration.

Another important safety appliance, namely, an effective means of communication between the engine-driver and guards of a train, or between the passengers and driver or guards, in case of emergency, is still, as a rule, in the crudest and least satisfactory shape. It generally consists of a cord running the whole length of the train, which, in the case of need, can only be reached by a passenger being able to let down the window and haul in a considerable length of slack cord. Obviously in a critical emergency such a performance would be utterly useless. More recently the communication cord or slender chain has been placed by some railways inside the carriages; in this position it is, of course, much more accessible and consequently efficient. Sometimes it runs along the floor and can be pulled up by an attached ring when necessary. A few trains have electrical communication throughout, which must certainly be the solution of the future. This plan was tried experimentally by Mr. Lloyd Price nearly half a century ago on one of the royal trains.

Railway Accidents.—Accidents upon railways are happily neither so numerous nor so fatal at the present day as they were in earlier periods of railway history. It is hardly probable that they can ever be wholly prevented, because, as has been already remarked, when every mechanical and automatic appliance has been provided the element of human fallibility, if only as regards construction, cannot possibly be entirely eliminated. Nevertheless there has been a gratifying decrease in the frequency and fatality of railway disasters of late years. Statistics cannot, it is true, be taken as a conclusive index on this point, because a single disaster attended by exceptional fatality—such as that of the Tay Bridge

in 1879, when more than 70 persons perished—unavoidably darkens the returns of the entire year. But on the whole the improvement in this respect is unmistakable. In the year 1900 only 16 passengers were killed on the railways of the United Kingdom from causes beyond their own control. That represents only 1 in every 71 millions of people that travelled, exclusive of season-ticket holders; if these latter be taken into account, then the number of passenger fatalities will be only about 1 in every 140 millions of travellers. 863 passengers were injured from causes beyond their own control; that would be at the rate of about 1 in every 2,500,000, including season-ticket holders. This must be deemed a very favourable result. In 1901 the accident statistics showed for the first time that not a single passenger had been killed by a train accident. The number of passengers injured in accidents to trains in 1901 was 476, as compared with 863 in 1900. Unfortunately, the mishaps to persons employed by the railway companies continued in 1901 to be still very numerous. No fewer than 511 railway servants were killed during the year, being at the rate of 1 in about every 1000 persons employed, while 4243 were injured. It is manifest in this respect that there is still room for much improvement in the direction of precaution and protective appliances.

Foreign Railways.—The railways constructed in countries outside of the United Kingdom originally were in many cases greatly inferior in quality. But of late there has been so rapid and persistent a tendency to 'level upward' that in a large number of cases the foreign railways compare very favourably with British. Those may be regarded as partially indicated by the relative positions of different countries with respect to maximum speeds. Up to the end of 1896 Great Britain was easily first, being unapproached by any other country in the world. In 1902 Great Britain has only third place in this respect, being led largely by America and in a considerable degree also by France. There are naturally many differences in detail between British and foreign railways, but perhaps the most salient one—indeed the only one that need be specially particularized—consists in the British use of the so-called 'bull-headed' rails supported on the sleepers by iron chairs, while on the European and American Continents the Vignole or flat-bottomed rail is more often seen. It is bolted direct to the wooden sleeper. The relative merits of the two systems are hotly disputed, and each plan seems to have many arguments in its favour. The American railways were originally constructed as cheaply as possible, with the object of opening up the country. But of late years they have been reconstructed with quite British solidity. In a lesser degree the same thing has happened in most of the British colonies. Many of the European railways are owned by the governments; others are under more or less direct government control than that which obtains in the United Kingdom. The advantages and disadvantages of State ownership and management constitute another large question as to which contemporary opinion is very widely at issue.

It is not easy to ascertain authentically the actual railway mileage possessed or worked by foreign countries, or even by all the British dominions. Various quasi-official returns that have been published are either incomplete or else mutually discrepant to such an extent as to inspire doubt as to their trustworthiness. According to what appears to be the most accurate of these published statistics, the length of railway open for traffic is 168,605 miles in Europe (including the United Kingdom):

220,657 miles in North America; 28,364 miles in South America; 35,580 miles in Asia; 15,860 miles in Africa; and 15,282 miles in Australia and New Zealand.

Legal Position of Railways.—The British railways are the property of joint-stock companies, who have constructed and who work them under powers granted by parliament. The Board of Trade appoints inspectors, confirms by-laws, sanctions the opening of new lines and mechanical arrangements for safety, and prosecutes companies for infringements of statutes. Companies are compelled to make annual returns of traffic, accidents, &c. The Board of Trade, by means of a staff of inspectors, conducts inquiries into accidents to trains which carry passengers, the reports of which are published as 'Blue Books', and in which recommendations in matters of safety are made. The Board of Trade inspects and sanctions the opening of new lines, and the safety signalling apparatus whenever altered. The powers and regulations of such matters are defined by the Act 5 and 6 Victoria, cap. 55, which enacts that if any railway, or portion of a railway, be opened without the notice prescribed, the company is to forfeit £20 per day until this is done. The Board of Trade is also empowered to postpone the opening, if such opening would be attended with danger to the public for any reason. The Board of Trade exercises a general power to supervise and see carried out on railways all general parliamentary enactments and orders in council, and has power to set in motion the officers of the crown, and to bring any breaches thereof before the proper courts. The general act conferring these powers is 7 and 8 Vict. cap. 85 (1844). The more recent act of 1889, passed after the awful sacrifice of life in the Armagh accident, caused by the use of non-automatic brakes, gives extensive powers to the Board of Trade to oversee the safety of the public, and to make orders for that purpose which the Railway and Canal Commission can enforce with its judicial powers on the application of the Board of Trade. The act provides that the Board of Trade may from time to time order a railway company: (a) To adopt the block system on all or any of their railways open for the public conveyance of passengers; (b) to provide for the interlocking of points and signals on or in connection with all or any of such railways; (c) to provide for and use on all their trains carrying passengers continuous brakes complying with the following requirements, namely: (1) The brake must be instantaneous in action, and capable of being applied by the engine-driver and guards; (2) the brake must be self-applying in the event of any failure in the continuity of its action; (3) the brake must be capable of being applied to every vehicle of the train, whether carrying passengers or not; (4) the brake must be in regular use in daily working; (5) the materials of the brake must be of a durable character, and easily maintained and kept in order. Also to make correct returns of overtime working by persons employed. The powers which the state exercises over railways in its capacity as general guardian of His Majesty's subjects is very clearly set forth in the Report by H.M. Royal Commissioners in 1900, appointed to inquire into the Causes of Accidents to Railway Servants, thus: 'Railway undertakings enjoy special privileges conferred upon them by the state. Amongst others, power is granted to them in their inception to take lands compulsorily, of making, subject to the approval of the Board of Trade, by-laws of a very extensive character, even affecting the public. Breaches of contract with them, offences against their by-laws, and even in some cases trespass against their property and premises, are consti-

tuted offences. Their liability as carriers is limited, and they possess special powers with regard to tolls. Companies that receive so many benefits from state interference will find it difficult to demonstrate that they ought to be exempted from it. On the other hand, the state already exercises large control over the railway companies, either directly by statute, or indirectly through the delegated authority of the Board of Trade and the Railway and Canal Commissioners. Directly by statute the state limits the speed of trains over level crossings, and fixes maximum tolls, rates, and terminal charges.' The labours of this Royal Commission resulted in an act of Parliament in 1900, called 'An Act for the better Prevention of Accidents on Railways', which conferred very extensive powers on the Board of Trade and its inspectors, the chief of which is to make rules as to dangerous operations on railways. A board of three railway commissioners was appointed in 1873 to control and arrange the traffic facilities, and arbitrate in disputes between companies. By the Railway and Canal Traffic Act of 1888 this body consists of two permanent commissioners, and is presided over in each country by a judge of England, Scotland, or Ireland respectively, and the court thus formed of three commissioners carries with it judicial powers proper to the supreme courts of each country. Of the two commissioners one has to be experienced in railway business. Besides the special acts passed for each railway company there are general acts bearing upon all, the most recent being that just mentioned. The powers of the companies as public carriers were set down in a general act passed in 1845, supplemented by others passed since. These acts deal with the rates and charges that railways can impose, settle the maximum rates for goods conveyed, the classification of goods, and generally regulate the powers of the companies in their relationship to the public. Every company must adjust with the Board of Trade or Parliament the classification of their goods traffic and the schedule of their maximum rates and charges, which, when adjusted, are embodied in a provisional order, and finally confirmed by a public general act. Special regulations are enforced as to through traffic and through rates, and as to the granting of undue preference in respect of rates to one trader or class of traders over others. The commissioners are to decide as to the legality of rates, tolls, &c., and enforce them so far as legal, and they may award damages to a party who complains of a grievance. A government duty of 5 per cent upon gross receipts from passenger traffic was early imposed upon the railways; but when the companies were compelled to run one train a day, at the fare of a penny a mile, they were exempted from the duty in respect of such 'parliamentary trains'. In 1883 the Cheap Trains Act abolished the duty on all fares not exceeding a penny a mile, and empowered the Board of Trade to require any company to provide proper accommodation at such fares, and also reasonable accommodation for workmen going to and returning from their work.

RAIMONDI, MARCO ANTONIO, usually called Marcantonio, famous as an engraver of Raphael's works, was born at Bologna in 1475 or 1488. Little more is known of his life than that he studied under Raibolini. In 1509 he proceeded to Venice, where he engraved Albert Dürer's *Life of Mary*, and *Life and Passion of Christ*. About 1510 he was in Rome, where he at first employed himself in engraving after Dürer's wood-cuts, but was shortly after employed by Raphael to make engravings of his works, and thus give them a European circulation, as Dürer had given his. In this he was completely successful.

The usual custom of the engravers of his time was to copy not from the completed pictures but the draughts, and one of the most important services which he rendered was the perpetuating in this way of a great number of designs and draughts, which Raphael either never completed at all, or produced in a much altered form. After Raphael's death he engraved works of Giulio Romano, Bandinelli, and others. Having engraved some plates after licentious drawings of the former artist, he was cast into prison by Pope Clement VII., and the impressions were suppressed. He was soon afterwards, however, not only released, but taken under the protection of the pope himself, from whom he also received employment. In 1527, on the taking of Rome by the Spaniards, he lost all his means, and returned in poverty to his native town. What afterwards became of him is unknown. Malvasia says that he was murdered.

RAIN, water dropping through the atmosphere. A mass of air in the atmosphere always contains some aqueous vapour, and if this air is cooled below a certain temperature, called the dew-point (which depends on the amount of vapour present), the vapour will condense into drops of water. This cooling may be due to radiation of heat to colder regions, or to mixture with colder masses of air. When air rises in the atmosphere to colder regions, or comes in contact with a cold part of the earth, or passes from equatorial to polar parts of the earth, its moisture tends to condense into rain. In considering the probable rainfall of a place we are concerned with its latitude, its elevation above the sea, its proximity to the sea, the laws affecting its seasonable variations, the prevailing winds, and the configuration of the surrounding surface. Low latitudes have in general a heavy rainfall, because of the greater evaporation in tropical regions, and the consequent formation of rain when the clouds due to evaporation get colder in the higher regions of the atmosphere. Hence also winds blowing from the equator are generally moist, and winds blowing to the equator are generally dry. The presence of forests tends to increase the rainfall (see METEOROLOGY), and the rain further encourages vegetation. The influence of the seasons on rainfall is pretty regular in the tropics. Over the ocean the skies are clear where the trade-winds are blowing steadily, and heavy rain falls by day in the zone of calms; on land there is a regular alternation of dry and wet seasons. Towards the equator, where there is a considerable interval between the two passages of the sun across the zenith, there are two rainy seasons. In monsoon regions, however, the alternation of dry and wet seasons depends on the winds. Beyond the tropics we have variable winds and variable rainfall. The following table gives recent figures for the mean annual rainfall of a number of stations in various parts of the world:—

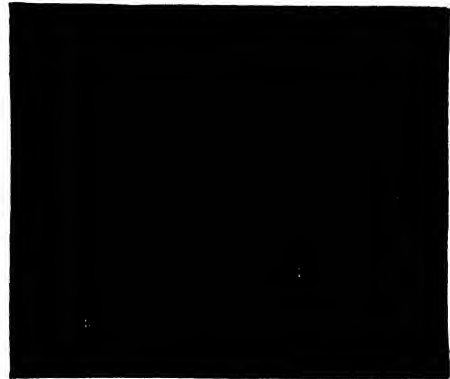
	Inches		Inches
Cherra-Punji (Assam)	464	Bergen	73
Greytown (Nicaragua)	200	Batavia	71.4
Stye, near Scathwaite.		Bombay	70.8
Cumberland	177	Vera Cruz	67.9
Ben Nevis	151	Calcutta	65.6
Freetown (Sierra Leone)	125.8	New Westminster..	64.37
Serra da Estrella.	116	Tokio	60.4
Rangoon	99	Manila	55.2
Bahia	95.1	New Orleans	55.17
Batum	93	St John's (Newfound-land)	52.9
Rockingham Bay (Queensland)	90	Brisbane	52.36
Colombo	88	Sydney	49.86
Glyncorrwg (Wales)	87.5	Madras	48.69
Astoria (Oregon)	80.3	Havana	46.5
Mangerton, near Killarney	86	Quebec	46.07
Saigon	82.96	Glasgow	45.4
Nagasaki	77.6	Halifax (Nova Scotia)	45.34
Domsten (Norway)	77	New York	44.76
		Auckland	43.62
		St. Louis	40.69

	Inches.		Inches.
Bern	39.61	Mexico	22.9
Durban	39.48	Bloemfontein	21.29
Montreal	39.28	Moscow	21.1
Bogotá	39	Upsala	21.1
Pietermaritzburg	38	Lahore	21
Chicago	37.67	Port Elizabeth	20.93
Kingston (Jamaica)	35.79	Adelaide	20.25
Toronto	34.4	Winnipeg	20.12
Buenos Ayres	34.1	Marseilles	20.08
Belfast	34	Paris	19.68
Dunedin	34	Spurn Head	19.1
Perth (Australia)	32	St. Petersburg	18.8
St. John (New Brunswick)	31.75	Tobolsk	18.6
Ottawa	31.4	Kimberley	18.26
Rome	30.6	Ikutak	16.6
Berlin	29.98	Denver	14.9
Liverpool	29.01	Santiago (Chili)	14.1
Dublin	28.4	Odesa	14
Edinburgh	28.32	Yakutsk	13.7
Christchurch (N Z)	28	Valparaiso	13.6
Algiers	26.72	Vladivostock	13.2
Charlottetown	26.71	Almeria	10.1
Melbourne	26.6	North Cape	10
Smyrna	25.63	Regina	8.38
Cape Town	25.01	Okhotsk	7.6
London	25	Multan	6.79
San Francisco	24.08	Jacobabad (Sind)	4.1
Vienna	23.42	Yuma (Arizona)	2.9
Nairn	23.3	Cairo	1.34
Bathurst	23	Walvisch Bay	.3

The form of water known as rain is generally exceedingly pure; it contains such gases as may be derived from the atmosphere—oxygen, nitrogen, and carbonic acid—particles of organic matter, and, in towns, of dust. On the impurities of rain-water, see the article WATER.

RAINBOW. Newton first properly explained the formation of the rainbow, by showing it to be due to the unequal refrangibility of elementary rays. A rainbow appears as a set of bands of colour which graduate into one another, and we can imagine each of these divided into very fine bands, such that the difference in colour between one of these thin portions and its neighbour is very small, and may be considered as occurring *per saltum* in going from one band to another. One such band may be considered as produced by a set of raindrops lying on the surface of

Fig. 1.



a circular cone whose vertex is the eye of the spectator, and whose axis is the line produced through the eye of the spectator from the centre of the sun.

Suppose a raindrop IAI' (fig. 1) to be receiving parallel rays of homogeneous light coming in the direction SI . Suppose θ , the angle of incidence of any ray, as the axis of SI , θ' the angle of refraction, and μ the index of refraction for the particular light. The deviation for each of the refractions at I and I'

is $\theta - \theta'$, and for the reflection at A it is $\pi - 2\theta'$. Therefore total deviation,

$$D = \pi + 2(\theta - 2\theta') \dots \dots \dots (1)$$

$$\sin \theta = \mu \sin \theta' \dots \dots \dots (2)$$

See OPTICS.

The angle between the emerging and the incident ray is greatest when $\sin \theta = \sqrt{\frac{4 - \mu^2}{3}}$. It is also found that a small beam in the neighbourhood of I will converge to a focus at A, and will emerge at I' in a nearly parallel beam. This beam will be the brightest of all those reflected from the back of the drop, and is that from which the eye will receive the impression of its particular colour. If we employ a different light, μ will be slightly different, and the path through the raindrop will be slightly different. When a beam of solar light falls upon a small area of the drop at I it is separated by refraction, and the separated sets of rays issue at another small area I', the angle of divergence of any two colours being equal to the angle subtended by those colours in the rainbow at the eye of the spectator.

The indices for red and violet rays from air into water are $\frac{4}{3}$ and $\frac{13}{11}$, and it is easy to calculate the angles subtended at the observer's eye by straight

Fig. 2.



lines from the brightest points of these colours to the centre of the bow. They are found to be $42^\circ 2'$ for the red and $40^\circ 17'$ for the violet. The formation of the secondary bow is explained in a similar manner. In this case the rays undergo two reflections, as represented in fig. 2. In the secondary bow the colours occur in inverted order—that is, the red is nearest to the centre. Rainbows are also produced by the sun shining on the spray of cascades. A broken rainbow mostly occurs from the field not being filled with falling rain, but it will also happen when the sun is invisible from part of the field.

RAIN-GAUGE, or **PLUVIOMETER**, an instrument which measures the depth of the rainfall at any place. In its commonest form it consists of a cylindrical vessel closed at the top by a funnel-shaped lid, through a hole in the centre of which the rain falls. A narrow glass tube, rising outside the vessel from near the bottom, shows by the height of the water in it the height of the water in the vessel itself. A very simple rain-gauge consists of a copper funnel, the area of whose opening is exactly 10 square inches. This funnel allows the rain to pass into a bottle, and the quantity of rain caught is ascertained by multiplying the weight in ounces by 0.173, which gives the depth in inches. As a rain-gauge is nearer the ground it is found to indicate a greater rainfall. This is partly due to the cold rain-drops getting larger in falling through the very moist air near the ground, and partly to the greater occurrence of eddies about the gauge at greater heights. Hence, when the rainfall at two places is to be compared, the

gauges ought to be similarly situated. A rain-gauge must be placed in as open a position as possible, out of the way of houses, trees, and similar objects.

RAINY LAKE, a lake in Canada, between Lakes Superior and Winnipeg, forming part of the boundary between Canada and the United States. It is about 40 miles long by 15 miles broad, receives the waters of numerous small lakes from the east and north-east, and empties itself by Rainy River, about 90 miles long, into the Lake of the Woods.

RAIPUR, a town of India, head-quarters of district of same name in the Chhatisgarh division, Central Provinces. It has an ancient fort, the usual government buildings, important schools, and a trade in grain, lace, cotton, &c. Pop. (1891), 23,759.

RAISINS are dried grapes. There are several methods of drying them. One is by cutting the stalks of the bunches, usually those containing the finest grapes, half through when ripe, and allowing them to shrink and dry upon the vine by the heat of the sun. Another and very common method is to cut off the bunches and lay them out on the ground to dry, or on specially prepared sloping areas covered with pebbles. In some cases the bunches are dipped into boiling water or in a boiling lye of wood-ashes and quicklime, after which they are exposed to the sun upon hurdles of basket-work. Those prepared by the first process are called *raisins of the sun* or muscatels, though the true raisins of the sun are dried on the vine without any cutting of the stem. Raisins are most largely produced in southern Spain, Asia Minor, and some of the Greek islands, to which may also be added California, Australia, and Cape Colony. Among the best are the large Malaga, Valencia, and Alicante raisins of Spain, and the seedless 'sultana' raisins, and 'eleme' raisins of Asia Minor. The well-known currants from Greece are really raisins. The quantity of raisins imported into Britain in 1900 was 658,371 cwts., of the value of £1,317,892; and the quantity of currants 824,527 cwts., value £1,820,001.

RAJAH, or **RĀJĀ**, a hereditary prince of the Hindus. Before the suzerainty of the country by the Moguls, rajahs governed the various countries of Hindustan, as they still continue to do in some instances, though they are more or less dependent on the British rule. They formerly belonged to the caste of Kshatriyas, or military caste, but the title may now be held by a member of any caste, and in many cases is merely honorary. A superior title is maharajah (great king), reserved formerly for those kings who had others under their sovereignty.

RAJAMAHENDRI, or **RAJAMANDRI**, a town of Hindustan, in the Godavari district, Madras, on the east bank of the Godavari (here 3 miles wide), 30 miles from the sea. Among buildings and institutions are the court-house and judge's residence overlooking the river, two churches, mission of the American Evangelical Lutheran church, provincial college, several schools, museum, dispensary, public garden, and large prison. Pop. (1891), 28,397.

RAJMAHAL, a town in Hindustan, Bengal, on the right bank of the Ganges, 203 miles N.N.W. of Calcutta by railway, long the acknowledged capital of the Bengal and Bahar provinces. It now has a deserted and ruinous appearance. It was ceded to the East India Company by Shah Alum in 1765. Pop. under 4000.

RAJPUTANA, a large province of India, in the west part of Hindustan proper, extending from the Jamna and Chambal Rivers, west to Sind and Bhawalpur, and comprising the greater part of the Indian Desert. It is subdivided into a number of states, which are subsidiary to the British, and comprised under the seven following assistant political

agencies: Meywar, Jaipur, Marwar, Haraoth, Eastern States agency, Alwar, and Sirohi; together with the British districts of Ajmir and Mairwara. The total area of the native states is 129,750 English square miles; or including the British districts of Ajmir and Mairwara, 182,461 square miles. The maharajahs and rajahs are supreme in their own states, and settle disputes among themselves in courts of their own. A great portion of the surface of Rajputana is desert, and part of it wholly destitute of inhabitants, water, and vegetation. The whole of the soil is remarkably saline, containing many salt springs and salt lakes, and much of the well-water is brackish. In many places it is covered with the cactus and other prickly shrubs, but except in the hilly parts the territory is almost destitute of trees. The Rajput nation is said to be a branch of the Kahetriyas, one of the four great castes into which the Hindus were originally divided. They are essentially a military people, and many of their institutions bear a strong resemblance to the feudal customs which prevailed in Europe in the middle ages. They have likewise been celebrated for their chivalrous spirit, so unlike the effeminacy and duplicity of many of the oriental nations; but they are also unfortunately open to one or two revolting charges, which it is impossible even for their greatest admirers to deny. The darkest of these is the practice of female infanticide, which at one time was horribly prevalent, and has only of late years been suppressed by the powerful aid of British influence. The profuse use of opium has likewise in many cases produced a lamentable deterioration in their physical and moral state. Notwithstanding these serious drawbacks the Rajput character contains much that is noble and generous, and considering the beneficial effects which have already resulted from their connection with Britain, a much greater improvement may warrantably be looked for in the course of time. The Rajputs became first connected with the British government under the governorship of the Marquis of Wellesley, in the beginning of the present century. Pop. in 1891, 12,631,220.

RAKE, a term applied to the deviation of the masts from the vertical line of position, reckoned from the keel forward or aft; also applied to the projection of the upper parts of a ship, at both ends, beyond the extremities of the keel.

RAKE, an implement of husbandry, consisting of a bar of wood or iron having wooden or iron teeth inserted into it, and attached to a long handle. The wooden rakes are used principally in the fields for raking together or collecting hay, straw, &c. Iron rakes are indispensable in gardens, for smoothing the surface of the soil and the like. Rakes are sometimes adapted so as to be drawn by horses. In England an implement called the *ell-rake*, having a triangular frame for a handle and curved teeth, is much used in hay-fields.

RAKING, the act of cannonading a ship on the stern or head, so that the balls range the whole length of the decks, which is one of the most dangerous incidents that can happen in a naval action. This is frequently called *raking fore and aft*, and is similar to what is termed by engineers *enfilading*.

RAKOCZY, a famous princely family, now extinct in the male line, which for some time ruled the principality of Siebenbürgen or Transylvania, and by maintaining the civil and religious rights of the inhabitants made itself equally serviceable to them and formidable to the house of Austria. The first prince of the name was SIGISMUND RAKOCZY, who obtained the government in 1606, but resigned it in 1608 in favour of Gabriel Bathori.—GEORGE, son of the former, was, after the death of Bathori and

Bethlen Gabor, restored to his principality in 1620, leagued with the Swedes during the Thirty Years' war, and in 1645 obtained for those of his subjects who, like himself, had embraced Protestantism, a peace which gave them back more than ninety churches that had been wrested from them, and numerous lost privileges.—He died in 1648, and was succeeded by his son, GEORGE II., who, failing in his attempt to be elected to the throne of Poland, vacant through the death of Casimir V., entered into an alliance with the Swedes, and invaded Poland at the head of a large army; but was completely defeated by the Poles, aided by the Austrians, on July 16, 1657. Abdicating in 1658, in consequence of the action of the Porte, he shortly afterwards contrived to regain his authority, but was soon forced from his position, and died in 1660. His son FRANCIS was implicated in a plot against the imperial government of Austria, and but for the intervention of his mother would have paid for his complicity with his life. In the latter years of his life, which terminated in 1676, he compiled a book of prayers, *Officium Racoecianum*, which obtained a wide circulation.—FRANCIS LEOPOLD RAKOCZY, prince of Siebenbürgen, and son of the preceding, after the Emperor Leopold I. had subdued it in 1689, lived as a private man on his own estates, but having, in consequence of fruitless negotiations with Louis XIV. of France, been arrested, was thrown into prison. He made his escape in 1701, and, bent upon revenge for the sentence of condemnation which had been passed upon him, determined to free Hungary from Austrian domination. He was soon at the head of 100,000 malcontents, and as the emperor, in consequence of the Spanish war of Succession, was unable to bring any effectual force against him, pillaged the greater part of Hungary and Moravia, took many fortresses, and suddenly advanced almost to the gates of Vienna. Leopold would now gladly have made peace, but could not make up his mind to agree to Rakoczy's stipulations—to convert Hungary into an elective monarchy, to give full toleration to all forms of religion, to confirm Rakoczy himself as Prince of Siebenbürgen, and to restore to him and his followers all the lands of their fathers. The victory of Marlborough and Prince Eugene at Blenheim enabled the emperor to bring a greater force against Rakoczy, who had not yet been able entirely to conquer Transylvania. During the preparations the emperor died in 1705, but his son and successor, Joseph I., succeeded, by the mediation of Holland and England, in making peace with the malcontents. Rakoczy refused to accede, and Austria commencing the war with renewed vigour gained many signal advantages. Rakoczy's former good fortune appeared to have forsaken him. An attempt to engage the Turks in his cause failed; the plague began to rage among his troops; a visit to Poland, where he endeavoured to gain Peter the Great, also failed; and the Hungarians, taking advantage of his absence, concluded a separate peace, and Rakoczy was glad to come to any terms. He retired to France, and afterwards to Roumelia, where he died in 1735. He left *Memoires sur les Revolutions de Hongrie*, which display much talent.

RAKOCZY MARCH, a simple yet stirring march by an unknown composer, and a very favourite one with the army of Francis Rakoczy II. In the war of 1848 and 1849 it was adopted by the Magyars as their national march, and is said to have had as inspiring an effect upon them as that exercised by the *Marseillaise* on the French. Like that one it also was opposed by the government, the Austrians having made various attempts to suppress it. A weak paraphrase of the march was made in 1824, and in

this form it is most generally known in Germany and elsewhere.

RALEIGH, a city in the United States, capital of North Carolina, 135 miles s.w. of Richmond in Virginia, on the North Carolina Central Railway. It is regularly and neatly laid out, containing a large and four smaller squares; and has a state-house, a massive granite structure after the model of the Parthenon, 166 feet long, 90 feet wide, and surrounded by massive columns of granite, 5½ feet diameter, and 30 feet high, and surmounted by a beautiful dome; a court-house, jail, governor's house, a theatre, a market, churches of various denominations, several academies and schools, a deaf and dumb institution, iron-foundries, a machine-shop, &c., and a considerable trade. Pop. (1880), 9265; (1890), 12,678.

RALEIGH, or **RALEGH**, **SIR WALTER**, a distinguished warrior, statesman, and writer in the reigns of Elizabeth and James I., was the second son of a gentleman of ancient family in Devonshire. He was born in 1552 in that county, and was sent to Oriel College, Oxford, where his proficiency gave a high opinion of his capacity. His active disposition and martial ardour led him, at the age of seventeen, to join a body of gentlemen volunteers raised to assist the French Protestants. He subsequently accompanied the forces sent under General Norris to assist the Dutch, and afterwards accompanied his half-brother, Sir Humphrey Gilbert, in a voyage to Newfoundland. On his return in 1580 he distinguished himself in the Irish rebellion, and was rewarded for his services by a considerable estate in Ireland. His favour at court was advanced by a well-known act of gallantry. The queen, in a walk among a crowd of courtiers, having come to a spot in which the path was obstructed by mire, Raleigh immediately took off his rich plush cloak and spread it on the ground for a foot-cloth. In 1584 his active disposition was manifested in a scheme for the discovery and settlement of those parts of North America not already appropriated by Christian states. By his interest he obtained a very extensive patent for this purpose; and with the help of friends two ships were fitted out. These vessels having carried home cargoes that sold well, a second expedition of seven vessels followed, under the command of Sir Richard Grenville, Raleigh's kinsman. Persons were taken over to colonize Virginia, so called in honour of Queen Elizabeth, but this attempt at colonization failed. To this period we owe the introduction of tobacco and the potato-plant into Europe. In the meantime he was honoured with knighthood, and rewarded by several lucrative grants, including a large share of the forfeited Irish estates. He was one of the council to whom the consideration of the best means of opposing the Spanish armada was intrusted, and was among the number of volunteers who joined the English fleet with ships of their own. In 1589 he accompanied the expelled King of Portugal in his attempt to reinstate himself, for which service he received several additional marks of favour and emolument; for although fond of glory, he was almost equally so of gain. On his return from Portugal he visited Ireland, and contracted an intimacy with Spenser, who celebrated Sir Walter under the title of the Shepherd of the Ocean, and to his Faery Queen prefixed a letter to him explanatory of its plan and design. The latter, in return, introduced the poet to Elizabeth. In 1592 he commanded an expedition with a view of attacking Panamá; but was recalled by the queen, and soon after incurred her displeasure by an amour with one of her maids of honour, the daughter of Sir Nicholas Throckmorton. Although he made the best reparation in his power, by marrying that lady, he was imprisoned for some months, and banished the

queen's presence. To recover favour he planned an expedition to Guiana, in which he embarked in February, 1595, and reached the Orinoco; but was obliged by sickness and contrary winds to return, after having done little more than take a formal possession of the country in the name of Elizabeth. In 1596 he had so far regained favour that he had a naval command under the Earl of Essex, with whom a difference ensued that laid the foundation of a lasting enmity between them. Sir Walter was subsequently fully restored to the good graces of Elizabeth, who nominated him to the government of Jersey. He witnessed the ruin of his antagonist, the Earl of Essex, whose execution he urged, and personally viewed from a window in the armoury. The speedy death of the queen, which this very catastrophe hastened, put a period to his prosperity. James I., whom, with some other courtiers, he sought to limit in his power of introducing the Scots into England, resented that attempt, and disliked him as the enemy of his friend the Earl of Essex. Although received with external civility at court, he was deprived of his post of captain of the guards, and evidently discountenanced. This treatment preyed upon his high spirit; and a conspiracy having been formed for the purpose of placing upon the throne the Lady Arabella Stuart, Sir Walter was accused of participating in it by Lord Cobham, to whose idle proposals he had given ear without approving them. He was brought to trial in November, 1603, and by the base subservience of the jury was declared guilty of high treason, even to the surprise of the attorney-general Coke himself, who declared that he had only charged him with misprision of treason. Raleigh was relieved, and committed to the Tower, where his wife, at her earnest solicitation, was allowed to reside with him, and where his youngest son was born. Though his estates in general were preserved to him, the rapacity of the king's minion, the infamous Carr, afterwards Duke of Somerset, seized on his manor of Sherborne, upon a flaw found in Raleigh's prior conveyance of it to his son. It was not until January, 1616, after twelve years' confinement, that he obtained his liberation, during which interval he composed the greater part of his works, and especially his *History of the World*. He was only released at last by the advance of a largesum of money to the new favourite Villiers, and to retrieve his broken fortunes he planned another expedition to America. He obtained a patent under the great seal for making a settlement in Guiana; but, in order to retain a power over him, the king did not grant him a pardon for the sentence passed upon him for his alleged treason. How far Raleigh knowingly deceived the court by his representations of rich discoveries and gold mines it is impossible now to ascertain; but having reached the Orinoco, he despatched a portion of his force to attack the new Spanish settlement of St. Thomas, which was captured with the loss of his eldest son. The expected plunder, however, proved of little value; and Sir Walter, after having in vain attempted to induce his captains to attack other Spanish settlements, arrived at Plymouth in June, 1618. In the meantime the Spanish ambassador had produced such an effect upon James, who was seeking the hand of the Infanta for his son Charles, that Raleigh was arrested and committed to the Tower. James had reason to be offended with the conduct of Raleigh against a power in amity with himself, and was willing to surrender him to the Spaniards; but the matter being referred to commissioners, with Chancellor Bacon at their head, it was decided to execute him on his former sentence. His plea of an implied pardon by his subsequent command was overruled; and the doom of death being pronounced against

him, it was carried into execution the following day (October 29, 1618), in Old Palace Yard. His behaviour at the scaffold was calm; and after addressing the people at some length in his own justification, he received the stroke of death with perfect composure. As a politician and public character Raleigh is doubtless open to much animadversion; but in extent of capacity and vigour of mind he had few equals, even in an age of great men. His writings are on a variety of topics, poetical, military, maritime, geographical, political, and historical. Most of his miscellaneous pieces have ceased to be interesting, but his *History of the World* is one of the best specimens of the English of his day, being at once the style of the statesman and the scholar. The compass of the work did not admit fullness of narrative, but he is often an acute and eloquent reasoner on historical events. The best edition of Raleigh's works is that published at Oxford in 1829 (eight vols.). There is a collection of his poems by Dr. Hannah (1885), and a selection from his writings and letters by Dr. Grosart (1892). Lives of Raleigh have been written by William Oldys (1736), P. F. Tytler (1833), Edward Edwards (1868), William Stebbing (1891), Major Hume (1897), besides others.

RALENTANDO, also **RITARDANDO** (Italian), in music, indicates that the time of the passage over which it is written is to be gradually retarded.

RAM, a steam ship of extraordinary strength and solidity, and propelled by powerful engines, used as an instrument of war. Its distinctive character is derived from the beak at its prow. This beak consists of a solid or nearly solid piece of iron, or wood armed with iron, fixed to the prow below the water line; it is flat underneath, and tapers towards its outer extremity nearly to a point. The vessel itself is otherwise constructed like the ordinary iron-clad, and may either have its battery broadside-wise or in revolving turrets. The beak is usually constructed as an independent adjunct to the ship, so that in the event of any serious collision it may be left buried in the hostile vessel, or if carried off in any other way may not occasion any injury to the vessel itself. The modern iron-clad ram was first used during the late civil war in America. In 1862 the ram *Merrimac*, belonging to the Confederates, destroyed with the utmost ease several of the Federal wooden vessels lying in the Hampton Roads.

RAM, BATTERING. See **BATTERING-RAM**.

RAMADAN, the ninth month in the Mohammedan year. It is devoted to fasting and abstinence. From sunrise to sunset for the thirty days of its duration the Mohammedans partake of no kind of nourishment. Eating, drinking, smoking, bathing, and all other bodily enjoyments, are absolutely interdicted. If a pious Mohammedan passes in the street an unbeliever having a cigar in his mouth he carries his hand to his mouth that there may be no possibility of a particle of the smoke entering. But whenever the sun disappears under the horizon all restriction is removed, and an immediate onslaught is made upon the viands. The cafés are filled, and the revels frequently continue throughout the whole night. The Mohammedan month being lunar there is no fixed period at which Ramadan occurs, and when it happens during the long hot days of midsummer the observance of the fast is particularly trying. In this case exemption is made in favour of those to whom it would prove really injurious, such as nurses, pregnant women, and others. At the termination of the month a great feast takes place, called *beiram*, and all labour ceases for a period of three days, during which they give themselves up to all manner of table enjoyments. The reason for the observance of the month Ramadan as a fast is that in it Mohammed

received his first revelation. The principal passages in the Koran referring to the fast of Ramadan are to be found in the second Surah.

RĀMĀYANA. See **SANSKRIT LANGUAGE AND LITERATURE**.

RAMBERG, JOHANN HEINRICH, distinguished for his paintings and etchings, was born in 1763 in Hanover. He first showed his talent by drawings of scenes in the Hartz Mountains. These drawings became known to the King of England, his sovereign as Elector of Hanover, who induced him to come to London, where he provided for him. He remained there nine years, and perfected himself under Reynolds, Murphy, Bartolozzi, and other engravers of the first rank in England, engraved drawings of his. In 1788 the king sent him to Italy, whence he returned to Hanover, where he was appointed painter to the court. Few painters and designers have produced so many works as he has; but this rapidity prevented the full development of his talent. Ramberg distinguished himself particularly in the humorous caricature. The drawings to the magnificent edition of Wieland's works are all by him; some he etched himself. He died in 1840.

RAMBOUILLET, a town of France, in the department of Seine-et-Oise, in a beautiful valley near the extensive forest of same name, 27 miles southwest of Paris. It has good houses, and regular, spacious, well-cleaned streets, but is, on the whole, a dull place; remarkable only for its château, long the residence of the kings of France, and a fine park, in which the first model farm in France was established; and for its sheepfold, which was the first depot of Merino sheep brought to France from Spain by Napoleon. From this flock have sprung the pure race and the mixed races of sheep, which constitute one of the greatest sources of wealth in the country. Shortly after the investment of Paris, on Oct. 4, 1870, a combat took place here between the French and Germans, in which the former were vanquished, and the town remained in the hands of the Germans till the conclusion of peace. Pop. (1896), 4186.

RAMBOUILLET, CATHERINE, MARQUISE DE, one of the most remarkable women of the seventeenth century, was born at Rome of Italian parents in 1588, and educated with great care by her mother. In 1600, when only twelve years old, she married Charles d'Angennes, son of the Marquis de Rambouillet, to whose title and estates he succeeded on the death of the latter in 1611. When the marquise appeared at the French court she was much shocked at the flagrant corruption of manners reigning there, and as her refined tastes did not permit her to derive any enjoyment from the mob of courtiers who assembled in the Louvre she conceived the idea of creating a select circle for herself. Her high rank, conjoined to her personal merits, made the execution of her design a comparatively easy matter. She caused the famous *Hôtel de Rambouillet* to be constructed after plans of her own, and soon had the satisfaction of seeing herself the centre of some of the most illustrious persons, in respect both of genius and rank, in the kingdom. Handsome and gracious, but free from coquetry and all personal pretensions, Madame de Rambouillet was admirably fitted to preside over these literary reunions, destined to become so famous. Her affability, generosity, and devoted attachment to her friends made her the idol of almost all who enjoyed her society. The writers of the period, too, are unanimous in the expression of her homage, which may be traced to the fact that among her other merits she possessed that of comprehending the true spirit of the society of the time. At her house might be observed the interfusion of the aristocracy of genius with the aristocracy of birth; the humblest man of

letters there met on terms of perfect equality with the highest noblemen in the land, so equitably did she exercise her patronage of letters. For more than fifty years this *salon* remained open, during which period more than one generation of distinguished men frequented it. At first it was Malherbe and Racan, followed by that illustrious circle of *beaux esprits* who contributed so much to the formation of the French language and taste—Coëtar, Sarrazin, Conrart, Patru, Balzac, Segrais, Godeau, Voiture, and Corneille; and finally the generation who filled up the interregnum between Corneille and Molière, Scarron, Saint-Evremond, Benserade, La Rochefoucauld, and others. Nor was the reputation of the Hôtel de Rambouillet much less for the illustrious women who frequented it than for the men; considering we meet with such names as those of Mademoiselle de Scudéry, Mademoiselle Colligny, afterwards celebrated as the Comtesse de la Suze, and who, with the Marquise de Sablé, inspired the Maximes of La Rochefoucauld. In the midst of the circle of distinguished women, illustrious alike for her singular beauty and faultless grace of manner, and adored by all who knew her, shone Mademoiselle Bourbon-Condé, better known afterwards as the Duchesse de Longueville, the heroine of the Fronde. It has been thought by some that the *Précieuses Ridicules* of Molière was aimed at exposing some of the foibles of this society; but Molière himself protested against the supposition that he meant to reflect on a circle which he affirmed had every claim to respect. The hôtel exercised a beneficial influence as well upon the language as upon the manners of the time; and the name of the Marquise de Rambouillet is inseparably associated with the annals of one of the most important periods of French literature and French society. The declining years of the marquise were darkened by trouble, occasioned partly by the removal or death of some of her dearest friends, and partly by other causes; but her *salon* still remained open, and it was only after her death, which took place in 1665, that it was closed. See Roederer's *Mémoire pour servir à l'histoire de la société polie en France pendant le dix-septième siècle*; and *Cousin's Jeunesse de Madame de Longueville*, &c.

RAMEAU, JEAN PHILIPPE, an able French theorist in the science of music, was a native of Dijon, and born in 1683. Having at an early age acquired some skill in music he joined a strolling company of performers, by whose assistance a musical entertainment of his composition was represented at Avignon, in the eighteenth year of his age. He was afterwards appointed organist in Clermont Cathedral, applied himself to the study of the principles of his profession, and in 1722 printed the first-fruits of his investigation in a treatise, entitled *Traité de l'Harmonie*. Four years after appeared his *Nouveau Système de Musique Théorique*, which was followed by his *Génération Harmonique*. In 1750 he published his celebrated *Dissertation sur le Principe de l'Harmonie*, in which he reduces harmony to one single principle—the fundamental bass, on which he proves all the rest to depend. This work procured him an invitation from the court to superintend the opera at Paris. He possessed a great facility in adapting words to music, and piqued himself so much upon this talent that he is said to have declared he would set a Dutch gazette if it was required of him. His remaining theoretical works are, *Remarks on the Demonstration of the Principles of Harmony*; *Reply to a Letter of M. Euler* (both printed in 1752); *On the Instinctive Love of Music in Man* (1754); *On the Mistakes of the Encyclopædia with Respect to Music* (1755); and a *Practical Code of Music* (1760). He was also the author of six operas, Hip-

polyte et Aricie, *Castor et Pollux*, *Dardanus*, *Samson*, *Pygmalion*, and *Zoroaster*, besides a great variety of ballets and other minor pieces. Louis XV. acknowledged his merits by the grant of a patent of nobility, and the order of St. Michael. Rameau died at Paris in 1764.

RAMEE, or CHINESE GRASS. See RAMIE.

RAMESES, or RAMSES (in Egyptian 'the Child of the Sun'), the name given to several Egyptian kings, especially of the nineteenth and twentieth dynasties. A king of this name is sometimes mentioned as belonging to the eighteenth dynasty, and as having reigned about 1590 B.C., but his proper name was Rames, and he does not seem to have reigned independently.—RAMESES I. was the first king of the nineteenth dynasty, and was not among the most remarkable of the series.—RAMESES II., grandson of the preceding, and son of Seti (the Sethos of Manetho), was the third king of the nineteenth dynasty, and reigned from 1340 to 1273 B.C. He was one of the most notable of all the kings of Egypt, and is identified by many students of Egyptian history with the Sesostris of Greek writers. (See SESOSTRIS.) His first achievement was the reduction of Ethiopia to subjection, which he accomplished in the beginning of his reign when he was still very young; but the great event of his reign was his war with the Khita, supposed to be the Hittites. He defeated a confederation among whom the Khita were the chief in a great battle near the Kadeshon (Orontes) in Syria, and in a subsequent stage of the war took Jerusalem and other places. He fortified the east of Egypt by erecting a great wall from Pelusium to Heliopolis, and he also constructed forts at Heroopolis and Tanis. In his reign Thebes rose to great magnificence. In this city he erected the splendid temple known as the Rhamession, with a sitting statue of himself sixty feet high. He is supposed to have been the king who chiefly oppressed the Hebrews, and the father of Menepthah under whom the exodus took place.—RAMESES III., the Rhampsinitus of Herodotus, belonged to the twentieth dynasty, and was also a king of some note, some of whose achievements seem to have been ascribed to Sesostris. He reigned for some 25 years about 1200 B.C., during which period he had to withstand many invasions of the surrounding nations, but he was uniformly successful in war, and active in great undertakings in time of peace. At Medinet-Abu he built a magnificent temple in memory of his warlike achievements in Nubia and Syria. The mummy of Rameses II. was found in 1881, that of Rameses III. in 1886. Eleven other kings of the name of Rameses are mentioned as having belonged to the twentieth dynasty. The last of them is supposed to have completed his reign about 1000 years before the Christian era.

RAMESES, a city of Egypt, supposed to be the same as Raames, one of the treasure-cities built for Pharaoh by the children of Israel during their bondage in Egypt. It was from this point that the Israelites set out in their exodus from Egypt; and its geographical position is therefore of great interest as determining their route towards the Red Sea. Various conjectures have been made as to its locality. Some have supposed it to be in the neighbourhood of On or Heliopolis; others somewhere near Old Cairo, on the opposite side of the Nile from ancient Memphis; Dr. Robinson placed it in the valley on Wady Toumilât, somewhere towards the east end of that valley, in the line of the Fresh-water Canal to Ismailia; and Dr. Lepsius thought he had found its site at Tell-el-Maskhuta, in that region, but this site has latterly been identified with Pithom or Succoth, and not with Rameses. It is argued in favour of the conjecture which places it in the neighbourhood

of Memphis, that Rameses must have been near the capital or residence of Pharaoh at the time of the exodus, and as this was Memphis, Rameses must therefore have been near this city. But though Memphis was the ancient capital, it does not follow that the Egyptian king invariably resided there. Tanis or Zoan was also a royal residence, and Brugsch identifies Rameses with it (that is, with the modern Sān), an identification which suits the biblical narrative quite well.

RAMESWARAM, a low sandy island between the southern extremity of India and Ceylon, and between the Gulf of Manaar and Palk Strait, about 14 miles long and 5 wide. It is one of the islands that form the chain known as Adam's Bridge, and contains a famous Hindu temple which attracts many pilgrims from all parts of India. The temple is a large and imposing structure, one of the finest specimens of Dravidian architecture. The port of the island is Pamban; it also contains a small town called Rameswaram. There is a passage for ships of moderate size between this island and the continent. Pop. of the island, 17,854.

RAMIE, **RAMEE**, a name applied to various fibre-plants of the nettle family or to the fibre yielded by them. The chief of these are *Boehmeria nivea*, or China Grass (also called *Urtica nivea*), and *Boehmeria tenacissima* (or *U. tenacissima*), which some maintain to be the true ramie plant. (See **BOEHMERIA**.) A kind of ramie has also been prepared from a common European nettle (*Urtica dioica*), and from *Laportea canadensis*, a North American nettle, introduced into Germany as a fibre-plant.

RAMILLIES, a village of Belgium, province of Brabant, 13 miles north of Namur and 28 south-east of Brussels. On May 23, 1706, the Duke of Marlborough gained here a signal victory over the French under Marshal Villeroi and the Duke of Bavaria. The numbers were about 60,000 on each side; the loss of the allies was 4000 men, that of the French 15,000. The consequence of this battle, the most important in the war of the Spanish Succession, was the immediate evacuation of Flanders by the French.

RAMISTS, the followers or disciples of Peter Ramus.

RAMMOHUN ROY, the founder of the Indian theistic sect the Brahmo-Somaj, was born in 1772, in the province of Bengal. Belonging to a wealthy family, he was well educated, studying Persian, Arabic, Sanskrit, logic, &c. He also paid a visit to Tibet to study Buddhism. For some years he was in the East India Company's service, but was raised to affluence by inheriting the family property. He commenced his literary career by the publication of a work in the Persian language, with a preface in Arabic, directed against idolatry, priesthood, and superstition. The freedom with which he animadverted on their respective systems gave great umbrage both to the Mohammedans and the Hindus, and created him so many enemies that he found it necessary to remove to Calcutta, where he took up his residence in the year 1814. Having studied the English language he very soon qualified himself to speak and write it with considerable facility, correctness, and elegance. He afterwards studied Latin, Greek, and Hebrew. A careful study of the sacred writings of the Hindus had convinced him that the prevailing religious notions of the Hindus were grounded upon a gross perversion of their religion, the original records of which appeared to him to inculcate a system of pure Theism. He now became anxious to reform the creed and practice of his countrymen, and determined to devote his talents and his fortune to this important and honourable undertaking. He translated the Vedānta, a compendium of the doctrines contained

in the Vedas or ancient sacred books of the Hindus, from the Sanskrit into the Bengali and Hindustani languages, and distributed the translation gratuitously. This he afterwards published in English, for the purpose of proving to his European friends 'that the superstitious practices which deform the Hindu religion have nothing to do with the pure spirit of its dictates.' From the perusal of the New Testament he found (he says) the doctrines of Christ more conducive to moral principles, and better adapted for the use of rational beings, than any other which had come to his knowledge. In 1820 he accordingly published a work entitled the Precepts of Jesus the Guide to Peace and Happiness, consisting chiefly of a selection of moral precepts from the Evangelists. About 1828 he originated the body subsequently known as the Brahmo-Somaj, or theistic church of India, a body brought into considerable prominence by the efforts of Babu Keshub Chunder Sen. Ram-mohun Roy, in his doctrinal views, was a Unitarian, holding, however, the pre-existence and superangelic dignity of Christ, and considering the doctrine of the Trinity as a species of polytheism. In 1831 he visited England in the character of ambassador from the King of Delhi (who gave him the title of Rajah), and while there was seized with a fever, which proved fatal. He died near Bristol on the 27th September, 1833.

RAMNÁD, a town of India, presidency of Madras, near the Gulf of Manaar. It has a fort, a palace, a Protestant and two R. Catholic churches. Pop. 10,519.

RAMNAGAR, a town of India, Benares district, N.W. Provinces, about 2 miles above Benares city. It is a considerable commercial centre, and the residence of the Maharajah of Benares. Pop. 11,859.

RAMPANT, in heraldry, a term applied to a lion, leopard, or other beast that rears up on his hind-legs, holding both pairs of feet, the one elevated in the posture of climbing, and showing his face in profile only. If the head is so turned as to present a front view of the face while the posture otherwise remains the same, it is called *rampant-gardant*; and *rampant-regardant* if the head is turned so as to look backwards. *Counter-rampant* is rampant towards the sinister, the opposite of the usual attitude. *Rampant* is different from *salient*, in which the beast seems springing forward. See **HERALDRY**.

RAMPART, in fortification, an elevation or mound of earth round a place, capable of resisting cannon-shot, and on which the parapet is raised. The rampart is built of the earth taken out of the ditch, though the lower part of the outer slope is usually constructed of masonry. The term in general usage includes the parapet itself.

RAMPHASTOS, the generic name of the toucans.

RAMPHORHYNCHUS. See **PTEROSAURIA**.

RAMPION, *Campanula Rapunculus*, a plant of the nat. order Campanulaceæ, or bellworts, indigenous to Britain, as well as to various parts of the continent of Europe. Its root may be eaten in a raw state like radish, and is by some esteemed for its pleasant nutty flavour. Both leaves and root may also be cut into winter salads. Round-headed rampion (*Phyteuma orbiculare*) and spiked rampion (*P. spicatum*) are also British plants, the roots and young shoots of which are occasionally used as an article of food.

RAMPUR, capital of a native state of the same name, North-western Provinces of India, on the left bank of the Kosila River, 18 miles E. of Moradabad. It is the residence of the nawab, and has manufactures of pottery, damask, sword-blades, and jewelry. Pop. (1901), 77,862.—The state, which is under the political superintendence of the government of the

North-western Provinces, has an area of 899 square miles and a pop. of 541,914.

RAMPUR BEAULEAH, town of India, capital of Rájsháhi district, Bengal, on the N. bank of the Ganges. It has a large traffic by river with the railway-station of Kushtia on the opposite bank. Pop. (1891), 21,407.

RAMREE, or **RAMRI ISLAND**, an island in the Bay of Bengal, off the coast of Burmah, to which it belongs, 40 miles long and 15 broad. It produces rice, indigo, sugar, petroleum, etc.

RAMSAY, **ALLAN**, next to Burns the most distinguished among the modern Scottish poets, was born on the 15th of October, 1686, at Leadhills, in Lanarkshire. His father was superintendent of Lord Hopetoun's mines there, and his mother, Alice Bower, was the daughter of a gentleman in Derbyshire. All the education which Allan ever received was at his native parish school in Crawfordmuir, where it is probable he merely went through the common routine of instruction to be had at such seminaries. The death of his father in early life prevented him, it is to be supposed, from receiving anything like a liberal education, and forced him to seek, while yet a youth, a means of livelihood in the Scottish capital. There he became bound as an apprentice to a *wig-maker*—an occupation which the greater part of his biographers are very anxious to distinguish from a *barber*, but with what degree of justice we know not. Allan himself, it would seem, was not ashamed of his trade, but continued in it long after his apprenticeship had ceased; nor did he abandon it for the more congenial pursuit of book-selling, until he had held for some time a name in the poetical world. The exact period when he commenced bookselling we cannot ascertain; but he is said to have been the first who established a circulating library in Scotland. The library was extensive, and continued to exist till a comparatively recent period. His first shop, as we learn from the imprint of some of his books, was 'at the sign of the Mercury, opposite to Niddry's Wynd;' but in 1726 he removed to a house at the east end of the Luckenbooths, and instead of Mercury, adopted for his sign the heads of Ben Jonson and Drummond of Hawthornden. In 1721 he published a collection of his poems, in one volume quarto, which was so liberally subscribed for, that he is said to have cleared by it 400 guineas. The greater part of the pieces in this collection had previously appeared at different periods in the form of sheets or half-sheets; and so popular had their author become, that it was quite customary for the good people of Edinburgh to send their children with coppers for Allan Ramsay's last piece. In 1724 the first volume of *The Tea-Table Miscellany*, a Collection of Songs appeared, which was soon followed by a second and third volume. The rapid sale of this compilation induced Ramsay to publish another, entitled *The Evergreen*, being a Collection of Scots Poems wrote by the Ingenious before 1600, which was equally successful. His next publication established his fame upon a sure and lasting basis. In 1725 appeared *The Gentle Shepherd*—the best pastoral perhaps in any language. Its success was instantaneous and unprecedented; edition followed edition with great rapidity; and it was not long till it was known by every lover of poetry, and—what bespeaks a higher popularity—till it had taken a place on the shelf of almost every cottage in Scotland. In 1728 a second quarto volume of his poems appeared; and in 1730 his *Thirty Fables*, which concluded his public poetical labours. The Fables are undoubtedly the best of Ramsay's lesser productions. Among them stands *The Monk and the Miller's Wife*; a story which, although previously

told by Dunbar, would, of itself, as a competent judge has remarked, be Ramsay's passport to immortality as a comic poet. He was now at the height of his celebrity: his acquaintance was courted by many distinguished individuals, and his shop was the common resort of the literary characters and wits of Edinburgh. In 1736 he took a principal part in the erection of a theatre in Carubber's Close, by which he came to considerable pecuniary loss; and it is remarked by his biographers, that this was perhaps the only unfortunate project in which he ever was engaged. In 1743 his wife died, to whom he had been married above thirty years; and soon after this, with the idea of relinquishing his shop, he built a house on the north side of Castle-hill, in rather a whimsical style of architecture. Here he spent the last twelve years of his life in a calm and pleasant manner; although he did not give up his shop until within three years of his decease. He died at Edinburgh on the 7th January, 1758, aged seventy-two; and was buried in Greyfriars' Churchyard, where a monument to his memory is erected. Another monument, erected in 1865, stands in Princes' Street Gardens. His son Allan, born 1713, died 1784, became famous as a portrait-painter, having studied in Italy under Solimena and Imperiali. In 1767 he was appointed principal painter to George III. His portraits are faithful, and free from affectation. He was also the author of several literary brochures, published under the title of the *Investigator*.

RAMSAY, **ANDREW MICHAEL**, better known by the name of the Chevalier Ramsay, was born in Ayr, in 1686. He was the son of a baker in opulent circumstances, who was able to give him a good education. After spending some time at the Universities of Edinburgh and St. Andrews, he went to Leyden, the university of which was at that time the common resort of the literary youth of Scotland. In 1710 he repaired to Cambray, on a visit to the celebrated Fénelon, who received him into his house as an inmate of the family, and by whom he was persuaded to embrace the Catholic faith. Fénelon's influence procured him the preceptorship to the Duke of Châteaue-Thierry and the Prince of Turenne. He was afterwards engaged to superintend the education of Prince Charles Edward Stuart and his brother Henry, afterwards Cardinal York, and for this purpose he removed from Paris to Rome in 1724. He died while residing with the family of Marshal Turenne, at St. Germain-en-Laye, on the 6th May, 1743. He published works of considerable merit both in French and English, including a *Life of Viscount Turenne*, a *Life of Fénelon*, the *Travels of Cyrus*, and a work on the *Principles of Natural and Revealed Religion*.

RAMSBOTTOM, a town of Lancashire, England, about 4 miles north of Bury, on the Irwell. Here the first Sir Robert Peel established calico-printing, and it is still a seat of the cotton manufacture, and of other industries. Pop. (1891), 16,726; (1901), 15,920.

RAMSDEN, **JAMES**, an eminent mechanist and optician, was born at Halifax in Yorkshire in 1735. He was the son of an innkeeper, and after receiving a fair education was apprenticed to a cloth-worker. Subsequently he applied himself to engraving, and in the course of his employment having to engrave several mathematical instruments, finally constructed them himself. He married a daughter of Dollond, the celebrated optician, and opened a shop in the Haymarket, whence he removed to Piccadilly, where he remained until his death in 1800. Ramsden obtained a premium from the board of longitude for the invention of a machine for the division of mathematical instruments. He also improved the con-

struction of the theodolite, the pyrometer for measuring the dilatation of bodies by heat, the barometer for measuring the height of mountains, &c.; also the refracting micrometer and transit instrument and quadrant. He made great improvements in Hadley's quadrant and sextant, reducing the limits of error from 5' to 30"; and procured a patent for an amended equatorial. He was chosen a fellow of the Royal Society in 1786, and such was his reputation that his instruments were bespoken from every part of Europe. He received the Copley medal from the Royal Society in 1795 in recognition of the importance of his various inventions. He died November 5, 1800, at Brighton.

RAMSEY, a town of England, in Huntingdonshire, on slightly rising ground in the fen country, 10 miles N.N.E. of Huntingdon, with some remains of a Benedictine Abbey founded in 969, and a spacious and interesting church. Other buildings and institutions worthy of notice are the grammar-school, the Abbey Rooms (with library), the Ramsey Institute, and the police-station. Pop. (1891), 4684; (1901), 4823.

RAMSEY, a seaport and watering-place of England, on the north-east coast of the Isle of Man, at the mouth of the river Sulby in Ramsey Bay, 13 miles N.N.E. of Douglas, with fine sands and hills in the background. The old town on the south bank is connected with the new town on the north bank of the river by a swing-bridge opened in 1892. The old town contains St. Paul's church, the market-place, and court-house; and in the new town are St. Olave's church, and the fine Mooragh Park. There are several other places of worship, and the two promenades, called Old and New, especially the latter, are worthy of mention. It is a favourite resort of tourists and pleasure-seekers, and has regular steam communication with Liverpool, Glasgow, &c. Pop. (1891), 4866.

RAMSGATE, a seaport and municipal borough of England, in the county of Kent, in the Isle of Thanet, 4 miles from Margate, at the entrance to Pegwell Bay. The older parts occupy a natural hollow or valley in the chalk cliffs that line this part of the coast, while the newer portions occupy the higher ground on either side, and comprise handsome streets, terraces, and crescents, as well as detached villas. The places of recreation and resort comprise a theatre, music-hall, assembly-rooms, iron promenade pier, and well-appointed bathing establishments, besides a fine stretch of sands. One of the churches is a handsome Gothic structure dating from 1827, with a lofty tower and spire; there are also a fine Roman Catholic church, places of worship for Baptists, Independents, Methodists, and others; Benedictine monastery and convent, Jewish synagogue, general infirmary, seamen's hospital, and a magnificent hotel, a Gothic building, with a tower 160 feet high. The harbour is formed by two piers, and nearly circular, comprising an area of 51 acres, and including a dry-dock and a patent slip for the repair of vessels. The east pier is 2000 feet long, and the west pier 1500 feet, both built of Portland and Purbeck stone and granite; the entrance to the harbour is 240 feet wide. Ship-building, rope-making, and brewing are carried on; there is a good coasting and some foreign trade (tonnage of vessels entered in 1900, 259,397 tons), and a considerable fishery. Ramsgate is now a popular watering-place. The Isle of Thanet electric tramways run along the

sea-front and in the suburbs. Pop. (1891), 24,738; (1901), 27,693.

RAMUS, **PETER**, or **PIERRE DE LA RAMÉE**, a philosopher of the sixteenth century, was born at Cuth, near Soissons, in 1515. He went to Paris about 1523, when he was but eight years old, and became a lackey in the College of Navarre. Such was his strong inclination for learning that he not only devoted to study all the time he could spare in the day, but also a part of the night. After attending a course of philosophy he was admitted to the degree of M.A., on which occasion he contested the infallibility of Aristotle. His opinions excited violent opposition; his publications were prohibited, and ordered to be burned before the Royal College of Cambray, and he was commanded to abstain from teaching his doctrines in 1543. Having obtained the patronage of the Cardinal De Lorraine, the prohibition of lecturing was withdrawn in 1547, and in 1551 he was appointed royal professor of rhetoric and philosophy at Paris. His spirit of free inquiry ultimately led him to become a Protestant. This change obliged him to flee from Paris, but in 1563 he was restored to his chair. In the massacre of St. Bartholomew's (Aug. 24, 1572) Ramus was one of the victims. His works, relating to grammar, logic, mathematics, &c., are numerous.

Ramus attempted a reform in science analogous to that effected by Luther and Calvin in religion. His keen perception enabled him to detect the defects of scholasticism and expose its worthlessness. By divesting Aristotle of his cloak of infallibility he rendered a new philosophy possible, and prepared men's minds for its reception by the introduction of a better method. His doctrines were widely diffused. France, England, and particularly Scotland, were full of Ramists. His logic was introduced into the University of Glasgow by Andrew Melville, and made considerable progress in the German universities.

RANA. See **FROG**.

RANCÉ, **ARMAND JEAN LE BOUTILLIER DE**, celebrated as the founder of the reformed order of La Trappe, was born at Paris in 1625, where he was educated. At the age of thirteen he wrote a Commentary on the Odes of Anacreon, which was afterwards published. After having graduated with distinction at the Sorbonne, he embraced the ecclesiastical profession, and before long was preferred to no fewer than six benefices, which the corrupt practice of the time allowed him to hold simultaneously. Residing at Paris, and in receipt of a large annual income from his several benefices, in addition to a considerable fortune left him by his father, he was unable to withstand the allurements of the capital, and gave himself up to a life of dissipation. In 1657, however, a marked change took place in his character. He ceased to appear at court, and determined to enter the cloisters. He disposed of his estate of Vêret, near Tours, applying the proceeds to religious purposes, and demitted all his benefices except the priory of Boulogne and the abbey of La Trappe. Retiring to the latter place in 1664, he began those reforms which have rendered his name famous. (See **LA TRAPPE**.) He passed thirty-three years in this retirement, during which he wrote a number of works, mostly of an ascetic character. In consequence of his growing infirmities he resigned his charge of the abbey in 1695, and died on October 27, 1700.

SUPPLEMENT.

PETRIE, WILLIAM MATTHEW FLINDERS, English Egyptologist, a grandson of Captain Flinders, the Australian explorer, was born at Charlton on June 3, 1853. He received a private education, and during the five years 1875-80 he carried out investigations in British archaeology, the results being published in the works, *Inductive Metrology*, or the *Recovery of Ancient Measures from the Monuments* (1877), and *Stonehenge: Plans, Description, and Theories* (1880). Proceeding to Egypt, he made a careful survey in 1881-82 of the Pyramids of Gizeh, of which he published an account in his work entitled *The Pyramids and Temples of Gizeh* (1883). In 1884-86 he continued his work in Egypt under the auspices of the Egypt Exploration Fund Committee. He excavated the site of Tanis, and discovered and excavated Naukratis, Am, and Daphnae, his results being published in works on Tanis (two vols., 1885 and 1887), Naukratis (1886), &c. From that date till the present he has continued his explorations of ancient sites with excellent results, his chief discoveries being associated with Hawara, Kahun, and Illahun (1889), Lachish (1890), Medum (1891), Tell el-Amarna (1891-92), Koptos or Kuft (1894), Nagada (1895), Thebes (1896), Deshashesh (1897), and Denderah (1898). These excavations form the subject of the works, Hawara (1889), Kahun (1890), Illahun (1891), Tell el-Hevy (1891), Medum (1892), Tell el-Amarna (1895), Koptos (1896), Nagada (1896), Six Temples at Thebes (1897), Deshashesh (1897), Denderah (1900), Royal Tombs of the First Dynasty (1900), Diospolis (1901), and Royal Tombs of the Earliest Dynasties (1901). Of his other publications we may mention: *A Season in Egypt* (1888); *Racial Portraits* (1888); *Historical Scarabs* (1889); *Ten Years' Digging in Egypt* (1893); *A History of Ancient Egypt* (begun 1894, still unfinished), of which he is editor and chief author; *Egyptian Tales* (1895); *Egyptian Decorative Art* (1895); *Religion and Conscience in Ancient Egypt* (1898); and *Syria and Egypt* (1898). Since 1892 he has held the Edwards professorship of Egyptology in University College, London, and he has received the honorary degrees of D.C.L., LL.D., Litt.D., and Ph.D.

PETROPOLIS, a town of Brazil, in the state of Rio de Janeiro, and 25 miles by railway from the city of that name. It is a popular place of residence for the wealthier inhabitants of the capital. Pop. about 12,000, including many Germans.

PETSH, or **IREK**, a town of European Turkey, in Albania, 73 miles N.E. of Scutari. It contains a famous monastery, once the residence of the Servian patriarch. Pop. about 12,000.

PETTIE, JOHN, R.A., distinguished painter, was born at Edinburgh on Mar. 17, 1839. He studied there at the Royal Scottish Academy, and in 1859 exhibited *The Prison Pet* at Edinburgh. In the following year he exhibited in the Royal Academy,

London, his picture being *The Armourers*. Remarkable alike for vigorous conception and technical dexterity, his historical and *genre* paintings have been numerous. Of these may be mentioned *What d'ye lack, Madam!* (1861); *George Fox refusing to take the Oath* (1864); *The Drum-head Court Martial* (1864); *Arrest for Witchcraft* (1866); *The Doctor* (1867); *Pax Vobiscum* (1868); *The Rehearsal* (1868); *Disgrace of Wolsey* (1869); *The Gambler's Victim* (1869); *Touchstone and Audrey* (1870); *Pedlar* (1871); *Scene in the Temple Gardens* (1871); *The Gypsy's Oak* (1872); *Terms to the Besieged* (1872); *Flag of Truce* (1873); *Midnight Watch* (1873); *Juliet and Friar Lawrence* (1874); *Jacobites* (1875—his diploma work); *Hal o' the Wynd's Smithy* (1875); *Sword and Dagger Fight* (1877); *Hunted Down* (1877); *The Laird* (1878); *The Death Warrant* (1879); *His Grace* (1880); *Trout Fishing in the Highlands* (1881); *Duke of Monmouth before James II.* (1882); *Jester's Merry Thought* (1883); *Reductio ad Absurdum* (1884); *Challenged* (1885); *The Chieftain's Candlesticks* (1886); *Two Strings to Her Bow* (1887); *The Traitor* (1888); and *Portraits* (1889). He also painted several portraits. He was elected A.R.A. in 1866, and R.A. in 1873. He died at Hastings on Feb. 21, 1893.

PETTY, SIR WILLIAM, economist, was born at Romsey, in Hampshire, on May 26, 1623. He went to sea in boyhood, but being abandoned on the French coast by his fellow-seamen he entered the Jesuit College at Caen. He afterwards joined the English navy, and subsequently studied at Utrecht, Amsterdam, Leyden, and Paris. Returning to England again in 1646, he carried on his father's business of clothier, but ere long he became a student of medicine at Oxford, graduating in 1649. He was afterwards appointed a fellow of Brasenose College, and in 1651 he received the chair of anatomy in the university. The post of physician-general to the army in Ireland was conferred upon him in 1652, and in this, as also in the work of surveying necessitated by the Cromwellian settlement of that country, he showed his great abilities. At the Restoration he gained the esteem of the king, and on the incorporation in 1662 of the Royal Society, of which he was one of the founders, he received the honour of knighthood. He afterwards held in succession the offices of judge of admiralty in Ireland and commissioner of the navy in England. Petty is principally remembered as an able and enlightened pioneer in economic science and the science of statistics. His chief contributions to these subjects are as follows: *Natural and Political Observations made upon the Bills of Mortality of London* (1662), prepared in collaboration with Captain John Graunt; a similar work on Dublin (1682); *A Treatise of Taxes and Contributions* (1662); *The Political Anatomy of Ireland* (1672); *Quantulumcunque concerning Money* (1682); *Another Essay in Political Arith-*

metic concerning the Growth of the City of London (1683); Two Essays in Political Arithmetic, concerning the People, Housing, Hospitals, &c., of London and Paris (1686); Five Essays in Political Arithmetic (1687), in defence of the preceding; Observations upon the Cities of London and Rome (1687); and Political Arithmetic, or a Discourse concerning the extent and value of Lands, People, Buildings; Husbandry, Manufacture, Commerce, Fishery, Artizans, Seamen, Soldiers; Public Revenues, Interest, Taxes (1690). Petty contrived various mechanical inventions, and read papers upon them and on other subjects to the Royal Society. In religion he held broad, tolerant views, and disliked the extreme Protestants as much as the Roman Catholics. He died in London on Dec. 16, 1687. See the biography by his descendant, Lord Edmond Fitzmaurice, published in 1895.

PETUNIA, a genus of South American herbaceous plants, of the natural order Solanaceæ, comprising about a dozen species, nearly allied to tobacco. They are much prized by horticulturists for the beauty of their flowers, which have a five-lobed, funnel-shaped corolla, are white, violet, or purple in colour, and spring singly from the leaf-axils. The leaves are sticky and like those of *Nicotiana*. The chief species are *P. violacea*, from Brazil, and *P. nyctaginigiflora*. The chief garden form is *P. grandiflora*, of which there are many varieties.

PEVENSEY, a parish and village in the south of the county of Sussex. The village is situated on the coast, 13 miles to the west of Hastings, probably on or near the site of the ancient Anderida. It contains an Early English church (restored) and a ruined castle which dates from Roman times. William the Conqueror landed near Pevensay in October, 1066. Pop. (1891), 437.

PFALZ. See **PALATINATE**.

PFALZBURG, a town of German Lorraine in the Vosges, 25 miles N.W. of Strasburg. It was strongly fortified by Vauban, and until 1870 (when the fortifications were razed) the town was of importance as commanding the passes of the Vosges. Here Erckmann, the French novelist, was born. Pop. (1890), 3844.

PFLEIDERER, OTTO, a distinguished German theologian of the liberal school, was born at Stetten in Württemberg on September 1, 1839. He studied theology under F. C. Baur in Tübingen University, and after a short period as assistant pastor near Reutlingen he was appointed lecturer on the foundation in Tübingen. In 1868 he became a pastor in Heilbronn, two years afterwards he went to Jena as chief minister and superintendent, and almost immediately thereafter he was promoted to the chair of practical theology in the university of the latter city, becoming at the same time a member of the grand-ducal church council. Since 1875 he has been professor of systematic theology in the University of Berlin. Prof. Pfeiderer has been throughout his career associated with the liberal movement in theology and Biblical criticism, and he is a member of the International Council of Unitarian and other Liberal Religious Thinkers and Workers, founded in 1900. He represents what may be called the Neo-Tübingen school, which carries on the work begun by Baur and Strauss. He was Gifford lecturer at Edinburgh in 1894. His published works include: *Die Religion, ihr Wesen und ihre Geschichte* (1869); *Moral und Religion* (1872); *Der Paulinismus* (1873; 2nd ed., 1890), translated into English as *Paulinism, a Contribution to the History of Primitive Christian Theology* (two vols., 1877); *Religionsphilosophie auf geschichtlicher Grundlage* (1878; 3rd ed., 1896), translated into English as *The Phil-*

osophy of Religion on the Basis of its History (four vols., 1886-88); *Geschichte der Religionsphilosophie von Spinoza bis auf die Gegenwart* (3rd ed., 1893); *Grundriss der christlichen Glaubens- und Sittenlehre* (Outlines of Christian Doctrine and Morality, 1880; 5th ed., 1893), a student's manual; *The Influence of Saint Paul on the Development of Christianity* (1885), a series of Hibbert lectures; *Das Urchristentum, seine Schriften und Lehren* (Primitive Christianity, its Literature and Doctrines, 1887); *The Development of Theology in Germany since Kant, and in Great Britain since 1825* (1890; 2nd ed., 1893; German ed., 1891), a masterly sketch; *Die Ritschlsche Theologie kritisch beleuchtet* (1891); and *The Philosophy and Development of Religion* (1894), his Gifford lectures.—His brother EDMUND, born at Stetten on Oct. 12, 1842, has held the professorship of philosophy in Tübingen since 1878, and has written works on Leibniz, Hume, modern pessimism, eudemonism and egoism, Kantian criticism, Lotze, Heraclitus, Socrates and Plato, causality, &c., besides two volumes describing his experiences as a field preacher during the war of 1870-71.

PHACOCHERE, **PHACOCÆRE**, the wart-hog of Africa, a pachydermatous mammal of the genus *Phacochærus*, akin to the swine. See **WART-HOG**.

PHAGEDÆNA, in medicine, a name given to a kind of obstinate gangrenous ulcer which eats into or corrodes the adjoining parts. See **ULCER**.

PHAGOCYTE, a white blood-corpuscle regarded as a destroyer of disease germs or microbes in the system according to the theory of *phagocytosis*.

PHALARIS, a small genus of grasses, of which the seed of one of the species, *P. canariensis*, or canary-grass, is extensively employed as food for birds, and commonly known as canary-seed. The inflorescence is a close spike-like panicle. See **CANARY-SEED**.

PHALLUS, a genus of fungi, forming the type of a family Phalloideæ of the division Gasteromycetes. The members of this family are sometimes of very striking appearance, and owing to their great attraction for insects, by whose means their spores are scattered, they are sometimes known as *flowering fungi*. *Phallus impudicus* (or *fetidus*), the stinkhorn fungus, is a bad-smelling species found in Britain. See **FUNGI**.

PHANARIOTS. See **FANARIOTS**.

PHARAOH'S RAT. See **ICHNEUMON**.

PHARNACES, a king of Pontus overthrown by Cæsar in 47 B.C., a victory announced in the famous message sent to Rome: *Veni, vidi, vici*. He was a son of Mithridates the Great, whose throne he usurped. For a time he enjoyed the friendship of Rome, but, taking advantage of Rome's internal troubles, he sought to extend his dominions.

PHASCOGALE, a genus of small marsupials, closely allied to the dasyures, found throughout Australia, New Guinea, &c. They bear some resemblance to rats, but are usually rather smaller. They feed on insects, and climb trees in order to get them. *P. penicillata*, or *Tapoa Tafa*, is one of the commonest species. It is a pretty little animal with a bushy tail.

PHASCOLOMYS, the generic name of the wombat (which see).

PHASEOLUS, the genus of leguminous plants to which belong the kidney-bean and scarlet-runner. See **FRENCH BEAN** in **SUPP.**

PHASMODÆ, spectre insects or walking-sticks, a family of orthopterous insects allied to the Mantidæ, restricted to warm countries, and remarkable for their very close resemblance to the objects in the midst of which they live, this peculiarity, known as *mimicry*, being their only protection against their

enemies. The family includes the genera *Phasma*, *Phyllium*, &c. Some of them are destitute of wings, and have the appearance of dead twigs, while the absence of motion in the insects adds to the deception. In others, as the genus *Phyllium*, the wings have the appearance of withered leaves, while the brighter hue of the wing-covers of a few of larger size give to the animal the appearance of a fresher leaf. See LEAF-INSECTS, MIMICRY.

PHEASANT'S EYE. See ADONIS in SUPP.

PHEASANT SHELL (*Phasianella*), a genus of gasteropodous mollusca of the family Turbinidae, found in South America, India, Australia, the Mediterranean, &c. The shell is spiral and obovate, the outside polished and richly coloured. Some of the animals of this genus have an ambling mode of progression. About thirty living species are known.

PHELPS, ELIZABETH STUART. See WARD (MRS. HERBERT) in SUPP.

PHELPS, SAMUEL, actor, was born in Devonport on Feb. 13, 1804, and died near Epping, Essex, on Nov. 6, 1878. He was apprenticed to a printer, but took to the stage in 1827, and ten years later was appearing in London in leading Shaksperian characters, and was one of the leading performers under Macready at Covent Garden. From 1844 to 1862 he directed Sadler's Wells Theatre with success, both pecuniary and artistic. He was regarded as the most accomplished Shaksperian actor of his day, excelling more especially in comedy parts such as Bottom, Justice Shallow, &c. In tragedy he belonged to the old school, of which indeed he was almost the last leading representative. He published a scholarly edition of Shakspeare in 1853.

PHENACETIN, $C_{10}H_{13}NO_2$, an acetyl derivative of amidophenol, occurring in small tasteless crystals. It is used to relieve headache or pain in neuralgia, and also to reduce the temperature of fevered patients, having much the same effect as antipyrin.

PHENYLIC ALCOHOL, same as carbolic acid (which see).

PHILADELPHIA. See ALA-SHEHR.

PHILATELY, a somewhat curious name now often used for the collecting of postage stamps, chiefly old and rare ones. Philately has now attained a position of some importance; rare postage stamps fetch very high prices, and some collections of them are worth many thousands of pounds.

PHILHARMONIC SOCIETY, a society founded in London in 1813 for encouraging instrumental and orchestral music. It has not only produced many works by British composers, but has also brought to England several great foreign composers to conduct at its concerts. Among these are Cherubini (1815), Spohr (1820 and 1843), Weber (1826), Mendelssohn (1829, 1842, 1844, 1847), Wagner (1855), and Gounod (1871), some of whom wrote works expressly for the society. Beethoven's great ninth symphony was written for the Philharmonic, and its timely aid helped to soothe the sadness of the great composer's last hours. Among its regular conductors have been most of the best-known of English nineteenth-century musicians.

PHILIP, one of the twelve apostles, according to John's gospel 'of Bethsaida, the city of Andrew and Peter', and who was called to follow Jesus at Bethany. After the resurrection he was present at the election of Matthias to the apostleship, but is not again mentioned. In the Western church he is commemorated on 1st May.—**PHILIP THE EVANGELIST**, often confounded with the above, is first mentioned in Acts vi. 5. He preached at Smyrna, where Simon Magus was one of his converts; baptized the Ethiopian eunuch; entertained Paul and his com-

panion on their way to Jerusalem, when 'he had four daughters which did prophesy'.

PHILIPHAUGH, a locality in Scotland 2 miles s.w. of Selkirk, near where Yarrow Water joins the Ettrick, the scene of Sir David Leslie's victory over the Marquis of Montrose, September 13, 1645. A monument marks the field.

PHILIPPOLIS, a town in the extreme south of the Orange River Colony, South Africa, about 40 miles to the north of Colesberg in Cape Colony. Pop. about 2000.

PHILLIMORE, SIR ROBERT JOSEPH, lawyer, was born at Whitehall on Nov. 5, 1810. In 1828 he entered Christ Church, Oxford, where he graduated B.A. in 1832 with distinction in classics, B.C.L. in 1835, and D.C.L. in 1838. In 1832-35 he was clerk to the Board of Control, but on being called to the bar in 1841 he set himself to develop an extensive practice. He rapidly came to the front in his profession, and was knighted in 1862. In 1852 he entered Parliament as member for Tavistock, but he sat there for only five years. In 1867 he was appointed judge of the high court of admiralty, and in 1871-72 he was judge-advocate-general. He was created a baronet in 1881, and two years later he resigned his judgeship. His death took place near Henley-on-Thames on Feb. 4, 1885. His works include: Commentaries on International Law (four vols., 1854-61), and a translation, with notes, &c., of Lessing's *Laocoon* (1874).

PHILLIPS, EDWARD, nephew of Milton, was born in London in August 1630. His mother was Ann, only sister of John Milton, and his father Edward Phillips, who was employed in the court of chancery, died in 1631, leaving young Edward to the poet's care. After a wide course of reading under his uncle's direction he entered Magdalen Hall, Oxford, in 1650, but left very shortly afterwards without graduating. He began publishing about 1653, and in 1654-55 he edited a volume of Poems by that most Famous Wit, William Drummond of Hawthornden. In 1658 he produced a dictionary of technical English words under the title *A New World of Words*, which passed through many editions. He supported himself thenceforward by private tuition and literary hackwork. The date of his death is unknown, but is sometimes stated to be 1696.—His younger brother, **JOHN PHILLIPS**, born posthumously in 1631, was educated from infancy by his great uncle. He assisted Milton in his work as Latin secretary to Cromwell's government, but not long afterwards he followed his brother Edward in renouncing the opinions in which he had been trained. He published several licentious works, and was at one time summoned before the council of state to answer for one of them. He took to hack-writing and pamphleteering, and from 1678 he was associated with Titus Oates and his stories about the Popish Plot. He died in 1706.

PHILLIPS, WENDELL, American abolitionist, son of the first mayor of Boston, Mass., was born in that city on Nov. 29, 1811. In 1831 he graduated at Harvard University along with J. L. Motley, and after studying law was called to the bar in 1834. He never seriously devoted himself to the practice of his profession, but early threw himself into the anti-slavery agitation begun by Garrison in 1831. He first came to the front at the great meeting of Dec. 8, 1837, in Faneuil Hall, Boston, where Dr. Channing was one of the speakers, and from that time till the final triumph of the abolitionist cause he wrote and lectured incessantly on its behalf. When Garrison resigned the presidency of the anti-slavery society in 1865, Phillips succeeded him and directed its affairs till its dissolution in 1870. He

latterly devoted his eloquence and untiring energies to the causes of negro rights, prohibition of the liquor traffic, woman suffrage, penal reform, and labour reforms. He died in Boston on Feb. 2, 1884. J. Russell Lowell has devoted one of his best poems to the memory of Phillips.

PHLEGMASIA, **PHLEGMON**, in medicine, a diffuse inflammation of the subcutaneous connective tissue in which the pus has a tendency to spread itself through the tissues. The name *phlegmasia dolens* is given to what is otherwise known as *milk-leg*, an ailment occurring in women after delivery, and consisting in a very painful swelling of the leg accompanied by fever.

PHOCÆA, in classical geography, the most northern of the Ionian cities of Asia Minor, on a peninsula between the Sinus Cymeus and the Sinus Hermæus, about 25 miles from Smyrna. It had two good harbours, and its inhabitants were noted seamen, traders, and colonizers. Their most important colony was Massilia, represented by the modern Marseilles. From the time of its conquest by the Persians under Cyrus, Phocæa steadily declined in importance.

PHOENIX ISLANDS, a group of small islands in the Pacific belonging to Britain. They lie in lat. 2° 30'–4° 30' s., and lon. 176°–180° e.; and several of them formerly yielded much guano, but the supply is now exhausted. Area, 16 square miles; pop. about 60.

PHOENIXVILLE, a town of the United States, in Chester county, Pennsylvania, on the Schuylkill, 28 miles n.w. of Philadelphia. It has extensive iron-works and hosiery-factories. Pop. (1890), 8514.

PHONETICS, the science which treats of the various sounds pertaining to human speech, their distinctive characteristics, the voice mechanism by which they are uttered, and the methods by which they may be best represented to the eye. Any system of writing is strictly phonetic when by it each different sound is represented by a different character, and the same sound always by the same character. See **PHILOLOGY**, **VOICE**, **WRITING**.

PHONOLITE. Same as **CLINK-STONE** (which see in **SUPP.**).

PHONOMETER, an instrument for ascertaining the number of vibrations of a given sound in a given space of time. Such instruments are usually made self-registering.

PHORMINX, an ancient Grecian lute or lyre. See **LYRE**.

PHORMIUM. See **FLAX (NEW ZEALAND)**.

PHOTO-ENGRAVING, a common name of many processes in which the action of light on a sensitized surface is made to change the nature or condition of the substance of the plate or its coating, so that it may by processes be made to afford a printing surface corresponding to the original from which the photographic image was derived. See **PHOTOGRAPHY**.

PHOTOGRAVURE, a process of engraving in which, by the aid of photography, subjects are reproduced as plates suited for printing in a copper-plate press. The process known as Heliogravure is essentially the same.

PHOTO-HELIOGRAPH, an instrument for observing transits of Venus and other solar phenomena, consisting of a telescope mounted for photography on an equatorial stand and moved by suitable clock-work.

PHOTO-LITHOGRAPHY. See **PHOTOGRAPHY**.

PHOTOSPHERE, the luminous envelope, supposed to consist of incandescent matter, surrounding the sun. See **SUN**.

PHOTO-ZINCOGRAPHY. See **PHOTOGRAPHY**.

PHRYNICHUS, an ancient Athenian poet who occupied an important position in the development of the Greek drama, flourishing about 512–476 a.c. See **DRAMA**, **GREECE—Literature**.

PTHIRIASIS, the technical name for lousiness. Three species of louse may infest the human subject, namely, the head-louse (*Pediculus capitis*), the body-louse (*P. corporis*), and the crab-louse or pubic louse (*P. pubis*).

PHYLOGENESIS, in biology, the race-history of an animal or vegetable type, a term much used by evolutionary biologists and philosophers. Hæckel has shown that ontogenesis, or the life-history of an individual, is a more or less imperfect recapitulation of its phylogenesis.

PHYSALIA, a genus of marine animals of the class Hydrozoa, of the sub-class Siphonophora. The *P. atlantica* is known by the name of the *Portuguese man-of-war*. These hydrozoa are characterized by the presence of one or more large air-sacs, by which they float on the surface of the ocean. Numerous tentacles depend from the under side, one class short and the other long. The shorter are the nutritive individuals of the colony, the longer, which in a *Physalia* 5 or 6 inches long are capable of being extended to 12 or 18 feet, possess a remarkable stinging power, and are probably used to stun their prey. See **PORTUGUESE MAN-OF-WAR**.

PIATIGORSK, a town in Cis-Caucasia, half-way between Vladikavkaz and Stavropol. It is a noted watering-place, and has hotels, pleasure-grounds, &c. Pop. 15,000.

PICA, a depraved form of appetite. See **APPETITE** in **SUPP.**

PICE, a small East Indian coin, about one-eighth of a penny in value.

PICHINCHA, a volcano of Ecuador, in the Western Cordillera, north-west of Quito; height, 15,560 feet. It gives name to a province of Ecuador, whose capital is Quito. See **ECUADOR**, **ANDES**.

PICHURIM-BEANS. See **PITCHURIM** in **SUPP.**

PICKERING, market town of England, in North Riding of Yorkshire, 32 miles north-east of York. It is a town of great antiquity. Its castle, whose ruins lie north-west of the town on a rocky height, is a very old building and was the prison of Richard II. in 1399. Pop. (1891), 3676; (1901), 3491.

PICTON, a town of Canada, in Prince Edward county, Ontario, on an arm of the Bay of Quinte, a tortuous gulf of the lake of Ontario, about 35 miles south-west of Kingston. Pop. (1891), 3287; (1901), 3698.

PICTON, **SIR THOMAS**, English general, was born in Aug., 1758, at Poyston, in Pembrokeshire. He entered the army at the age of thirteen as an ensign in the 12th foot, and was for three years located at Gibraltar. In 1778 he returned to England as captain in the 75th, and on the disbandment of his regiment five years later he retired to his native county for a considerable period. Failing to secure an appointment despite repeated efforts, he went to the West Indies in 1794, and by the influence of Sir John Vaughan, the commander-in-chief there, he became a major in the 68th and deputy quartermaster-general. He distinguished himself in the capture of St. Lucia in 1796, and was promoted lieutenant-colonel. After sharing in the operations against St. Vincent, Martinique, and Trinidad, he was appointed in 1797 by Sir Ralph Abercromby, his commander-in-chief, commandant and military governor of the last-named island. He administered the island with marked success, and in 1801 he became its civil governor, being soon afterwards promoted to the rank of brigadier-general. He resigned his post in 1803, and immediately afterwards took part in the

recapture of St. Lucia and Tobago, being appointed commandant of the latter. On proceeding to England he was arrested in consequence of charges of cruelty made against his administration of Trinidad, and in 1806 he was tried before the Court of King's Bench. After two trials of some length he was practically acquitted in 1810. He attained the rank of major-general in 1808, and took part in the Walcheren expedition in 1809. In 1810 he went to Portugal to command the third division under Wellington, and during the Peninsular War he greatly distinguished himself, especially at Busaco, Fuentes d'Onoro, Ciudad Rodrigo, Badajoz, Vittoria, Orthez, and Toulouse. In 1813 he was created a knight of the Bath, and in 1815 a knight grand cross. In the Waterloo campaign he commanded the fifth division and the reserve. He took part in the preliminary battle with Ney at Quatre Bras, and sustained a severe wound in the ribs, but he concealed the fact from all but his servant. In the great battle which ended the Napoleonic era he was killed by a ball which struck him on the temple.

PICUL, or **Tau**, in China, a weight of 133½ lbs. It is divided into 100 catties or 1600 taels.

PIEDCUESTA, a town of the republic of Colombia, in the department of Santander, on the Rio de Oro. It has a university, and manufactures of straw-hats, cigars, &c. The district is well wooded and well cultivated, among the products being tobacco and coffee. Pop. 9000.

PIEDRA-BLANCA, a town of the Argentine Republic, in the province of Catamarca, and about 6 miles north-east of that town. It is situated in a fertile and well-cultivated region, producing sugar, tobacco, cotton, and many fruit-trees. Pop. 6000.

PIERCE, FRANKLIN, fourteenth president of the United States, was born in Hillsborough, New Hampshire, on Nov. 23, 1804, and died at Concord on Oct. 8, 1869. He was bred to the law, and was called to the bar in 1827. In 1833 he was elected to Congress, where he sat till his retirement nine years later. In 1846 he became colonel of a regiment of infantry organized by his state to take part in the Mexican war, and in the following year President Polk raised him to the rank of brigadier-general. During the war he gained great distinction, but received severe injuries. In 1852 he became president as champion of the pro-slavery party. He was a sincere, honest, and able man, but his good qualities were unfortunately devoted to the support of what proved to be a losing cause, and what we now regard as a most unworthy though not entirely unreasonable position. See Nathaniel Hawthorne's *Life of Pierce* (1852).

PIERRE, capital of South Dakota, United States, in Hughes county, on the Missouri, 158 miles west of Huron. It has a university and a government Indian industrial school, and is situated in an agricultural and stock-raising district. Pop. (1890), 3236.

PIERREFONDS, a village of France, in the department of Oise, near Compiègne, remarkable for its castle, founded in 1390 and recently restored. Pop. 1800.

PIERS PLOWMAN. See **LANGLANDE**.

PIETA, in painting and sculpture, a representation of the Virgin embracing the dead Christ. In St. Peter's at Rome is a *Pieta* by Michael Angelo. Of painters who have chosen this subject we may mention Correggio (Parma Gallery), Anton van Dyck, Murillo, Rubens (Brussels Museum), and Titian (Venice Academy).

PIEZOMETER, an instrument for measuring the compression of water and other liquids under pressure. In Oersted's piezometer the pressure is

gauged by the manometer, and the amount of compression indicated by mercury in a glass tube.

PIGEON-BERRY. Same as *Pokeweed* (which see in **SUPP.**).

PIGEON ENGLISH, conjectured to be a form of 'business English'; a conglomeration of English and Portuguese words wrapped in a Chinese idiom, used by English and American residents in China in their intercourse with the native traders. See *Pidgin-English Sing-Song* by C. G. Leland (1876).

PIGEON-PEA, the fruit of the leguminous shrub *Cajanus indicus*, a native of India, but now cultivated in tropical Africa and the West Indies. It belongs to the papilionaceous section of the order, and has leaves consisting of three ovate-lanceolate, stalked leaflets. There are two varieties, distinguished as *bicolor* and *flavus*. The former reaches a height of from 3 to 6 feet, and has yellow flowers with crimson markings; the latter is larger, sometimes attaining a height of 10 feet, and its flowers are of a uniform yellow colour. In India the pigeon-pea forms a pulse of general use. The former variety is called also *Angola Pea* and *Congo Pea*.

PIKA, the calling-hare (*Lagomys*), an animal nearly allied to the hares, and forming the family *Lagomydæ*. It is found in Russia, Siberia, and North America, and is remarkable for the manner in which it stores up its winter provision, and also for its voice, the tone of which so much resembles that of a quail as to be often mistaken for it. They differ from hares not only in size but also in various skull-characters, the shortness of their ears, the apparent absence of a tail, &c. *L. princeps* inhabits the Rocky Mountains; *L. alpinus*, a larger species, about 9 inches long, is found throughout Siberia and even in European Russia.

PIKE-PERCH (*Lucioperca*), a genus of fishes closely allied to the perch, but showing a resemblance to the pike in its elongated body and head. Like the pike, it is a dangerous enemy to other fresh-water fishes, but the flavour of its flesh is excellent. In Europe it occurs in two species. It also occurs in the fresh waters of North America, such as the great lakes, the Upper Mississippi, and the Ohio. The chief European species is *L. sandra*, which attains a length of 3 or 4 feet, and weighs some 25 or 30 pounds.

PIKUL. See **PICUL** in **SUPP.**

PILEWORT. See **CELANHINE** in **SUPP.**

PILGRIMAGE OF GRACE, an insurrectionary movement in the north of England, in 1536-37, consequent upon the proceedings of Henry VIII. in regard to the church, and led in the first instance by Robert Aske, a Lincolnshire gentleman. The insurgents demanded the fall of Cromwell, redress to the church, and reunion with Rome. Mustering to the number of 30,000, they marched upon York, and within a few days were masters of England north of the Humber. Henry temporized, promising a free parliament at York; but when the insurgents returned home all concessions were revoked, and a renewal of the revolt was suppressed with great rigour. Many perished by the block, the gibbet, and the stake.

PILLAR, the name usually applied to columns in Gothic architecture. Pillars may be, unlike columns proper, of any cross-section, circular, square, octagonal, &c. They may be *simple* or *compound*, but in English Gothic simple pillars are comparatively rare. The arrangement of the shafts in a compound pillar, the shape of the central pillar or *body*, &c., vary considerably in the different styles, and are by no means constant even in the same style. See **COLUMN**, **ARCHITECTURE**.

PILOCARPINE, an alkaloid obtained from the

dried leaves of *Pilocarpus pinnatifolius*, a South American plant. It is a very powerful drug, and acts as an antidote in cases of poisoning by belladonna. See JABORANDI in SUPP.

PILOTY, KARL VON, German painter, born at Munich, October 1, 1826, died there July 21, 1886. He studied at the academy of Munich, and first gained fame by his picture of The Founding of the Catholic League (1854). In 1856 he was appointed a professor in the Munich Academy of Arts, and in 1874 he succeeded Kaulbach as director of the academy. He devoted himself chiefly to historical subjects, and among his works are: *Seni* by the Dead Body of Wallenstein; *Nero* among the Ruins of Rome; *Mary Queen of Scotland* receiving her Death Sentence; *The Murder of Caesar*; *Thusnelda* in the Triumph of Germanicus; *The Wise and Foolish Virgins*; *The Death of Alexander the Great*. Piloty is reckoned the most remarkable representative of the Realistic school of Germany. Several of his pupils (Makart for instance) have highly distinguished themselves.

PILUM. See JAVELIN.

PIMELODUS, a genus of malacopterygian abdominal fishes, found chiefly in South America, the Nile, and some of the eastern rivers, and supposed to abound in subterranean lakes, as one species (*P. cyclopus*), 6 inches long, is sometimes ejected in thousands from the craters of volcanoes.

PIMPINELLA. See ANISE.

PIMPLES are eruptions of the skin. Several varieties are distinguished by special names, but various causes may transform one of these into another. The *papule* is a solid elevation, in size between a millet-seed and a lentil, apparently containing no fluid, and either of the natural skin-colour, or bluish, blackish, &c. The *vesicle* is an elevation of about the same size, containing a clear or milky fluid; by alteration of its contents to yellow pus it becomes a *pustule*. A *bleb* or *bulla* is a larger vesicle or pustule, and may be as large as a hen's egg. A large papule is called a *tubercle*, and *wheel* is the term applied when the raised skin is of greater extent than elevation.

PINAR DEL RIO, a town of Cuba, capital of a province, on the southern slope of the western part of the island, in the tobacco-growing district known as *Vuelta Abajo*, about 100 miles south-west of Havana, with which it is connected by a railway. Pop. about 20,000.

PINASTER. See PINE.

PIND DADAN KHAN, a prosperous commercial town in the Jhelum district of the Punjab, British India, near the north bank of the Jhelum River, with a trade in salt. There are manufactures of brass and copper goods, and other articles. Pop. (1891), 15,055.

PINEAL GLAND, in anatomy, is a body (not properly a gland) forming part of the brain. It is about the size of a pea, and is connected with the cerebrum at its base by four peduncles or stalks and by some few cross fibres. Its use is not known. It was considered by the ancients to be the seat of the soul. It is now generally regarded as representing an aborted organ of sight or some other sense, but even in modern times various mystical potentialities have been ascribed to it.

PINE BLUFF, capital of Jefferson county, Arkansas, at the head of the low-water navigation of the Arkansas river, 42 miles to the south-east of Little Rock. It is in a cotton district, and has railway works and many mills. Pop. (1890), 9952.

PINE-CHAFER, or **PINE BEETLE** (*Hylophagus piniperda*), a species of beetle of the family *Xylophagi*, which infests Scotch pines. It feeds on the

young shoots of these trees and eats its way into the heart, thus converting the shoot into a tube. It is a pest very difficult to eradicate, but careful removal of infested shoots is important. The Scotch fir is also subject to the attacks of other coleopterous insects.

PINERO, ARTHUR WING, actor and dramatist, son of a solicitor, was born in London on May 24, 1855, and educated privately. He made his *début* upon the stage at Edinburgh in 1874, subsequently joining the Lyceum and Haymarket companies. Since 1881 he has ceased to act, and is now known as the author of several successful plays, including *£200 a Year* (1877); *The Money Spinner* (1880); *The Squire* (1881); *Lords and Commons* (1883); *The Rocket* (1883); *Low Water* (1884); *The Magistrate* (1885); *The Hobby Horse* (1886); *Sweet Lavender* (1888); *The Profligate* (1889); *The Second Mrs. Tanqueray* (1893); *The Notorious Mrs. Ebb-smith* (1895); *The Princess and the Butterfly* (1897); *The Gay Lord Quex* (1899); and *Iris* (1901). Mr. Pinero's plays are bright, witty, often satirical or caricaturist in tone, and occasionally of a more serious character.

PINEY TALLOW, called also *Malabar tallow*, Indian copal, piney varnish, &c., is a resinous substance obtained by cutting notches in the bark of the *Vateria Indica*, a tree of the order *Dipterocarpaceæ*, having panicles of whitish flowers, common on the Malabar coast. It forms excellent candles. A solid oil of similar character is also obtained from the seeds.

PINGUICULA, a genus of plants of the natural order *Lentibulariaceæ*, with rosettes of fleshy radical leaves, and solitary purple, violet, or yellow flowers. See *BUTTERWORT* in SUPP.

PINK-EYE, a contagious disease of horses, allied to influenza or scarlet fever. It usually breaks out in wet cold weather, and its chief symptoms are, besides the redness of the eye to which it owes its name, loss of appetite, feverishness, quickened pulse, and perhaps stiffness of the limbs and constipation. It usually runs its course in ten days or less, and is generally not fatal.

PINKIE, the name of a battle fought near Musselburgh on Sept. 10, 1547, in which the Scots under the Earl of Huntly were completely defeated with great loss by the English under the Protector Somerset.

PINK-ROOT. See *SPIGELIA* in SUPP.

PIN-MONEY, an annual sum of money, sometimes provided for in a marriage settlement, to be paid by the husband to the wife for her separate use, and to be applied in the purchase of apparel, ornaments for her person, or for private expenditure.

PINNATE, in botany, formed like a feather. A pinnate leaf is a species of compound leaf wherein a single petiole has several leaflets or pinnules attached to each side of it. If there is an odd terminal leaflet, the leaf is *impari-* or *unequally-pinnate*; otherwise it is *pari-* or *abruptly-pinnate*. A *lyrate* leaf is one of the former type in which the end leaflet is much larger than the others. See *BOTANY*.

PINOS, ISLA DE. See *ISLA DE PINOS* in SUPP.

PINSUTI, CIRO, musical composer, was born at Sinalunga, near Siena, on May 9, 1829. He received his earlier musical training under his father and various teachers in England, and in 1845 he entered the Bologna Conservatory, where he became a private pupil of Rossini. Three years later he again went to England, and became a teacher of singing in London and Newcastle. In 1856 he was appointed professor of singing in the Royal Academy of Music. He died at Florence on

March 10, 1888. His compositions include some operas, which were performed with success in Italy, but he is best known by his numerous fine songs. In 1859 he composed a *Te Deum* on the occasion of the annexation of Tuscany to Italy.

PINTADO. See GUINEA-FOWL.

PINTO, ALEXANDRE ALBERTO DA ROCHA SERPA, Portuguese traveller, was born at Tendas, in Douro province, on April 20, 1846, and educated at the Royal Military College, Lisbon. He entered the Portuguese army in 1863, becoming lieutenant in 1868, captain in 1874, major in 1877, and aide-de-camp to the king in 1880. In 1877-79 he crossed Africa from Benguela to Durban, and described his journey in a work entitled *How I Crossed Africa* (London, 1881), which procured him many honours, especially from geographical societies. He led several exploring expeditions, and his proceedings in the Zambesi district led in 1890 to a vigorous and successful protest by Britain against the claims of Portugal in that quarter. He died on Dec. 28, 1901.

PINUS. See PINE.

PIPE ROLL SOCIETY, an English society instituted for the publication of the Pipe Rolls, or Great Rolls of the Exchequer. These rolls, which relate to all matters connected with the revenue of the crown, crown lands, &c., are preserved in the Record Office. The earliest belongs to the reign of Henry I., and from Henry II.'s time to the present day the series is continuous and of very great importance. The society was established in 1883.

PIPETTE, an instrument used by chemists, druggists, &c., consisting of a glass tube with a bulging expansion about the middle, into which a certain quantity of liquid may be sucked by the mouth, so as to be transferred from one vessel to another. Each pipette bears a mark on its upper part and a number on the bulge. The number indicates in cubic centimetres the amount of liquid it contains when filled to the mark. A set of pipettes of different capacities is required in many chemical processes.

PIPING-CROW, a bird of New South Wales, remarkable for its musical powers, and for its power of mimicking the voices of other birds. It is the *Burita* (or *Gymnorhina tibicen*), black and white in colour, and by some naturalists is placed among the shrikes (*Laniidae*), by others among the crows (*Corvidæ*).

PIPPIN. See PEPIN.

PIPSISSEWA, also known as *chimaphila*, *prince's pine*, and *winter-green*, a North American plant (*Chimaphila umbellata*) of the heath order (*Ericaceæ*). From its leaves are made a powder and a fluid extract, used in America in kidney complaints, scrofula, rheumatism, &c.

PIQUA, town of Miami county, Ohio, United States, on Miami River, and Miami and Erie Canal, 90 miles north-east of Cincinnati. It is the second largest linseed-oil centre in the States, and carries on many other manufactures. Pop. (1890), 9090.

PIQUETBERG, a small town of Cape Colony, capital of a district of the same name, some 80 miles north of Cape Town and a few miles east of St. Helen's Bay. It stands in a good grain region.

PIRAI, or **PIRAYA,** the *Serravalno Piraya*, a voracious fresh-water fish of tropical America. It is 3 or 4 feet in length, and its jaws are armed with sharp lancet-shaped teeth, from which cattle when fording rivers sometimes suffer terribly. It belongs to the family Erythrinidæ or Characiniidæ.

PIROT, a Servian town, capital of a province of the same name, situated on the Nishava, some 35 miles to the south-east of Nisch. It has manu-

factures of carpets, cloth, and wine. In 1885 a battle was fought here, in which the Bulgarians defeated the Servians. Pop. 9920.

PISAGUA, a town on the coast of northern Chili, in the province of Tarapaca, some 40 miles north of Iquique. It exports cubic nitre, but is a bad port. Pop. 4262.

PISCIDIA, a genus of plants of the natural order Leguminosæ, the species being West Indian trees with winged pods. The bark of the root of *P. Erythrina* (Jamaica or white dogwood) is a powerful narcotic, and is used as a substitute for opium, and also for poisoning fish. The timber makes excellent piles for docks and wharfs, being heavy, resinous, and almost imperishable.

PISCO, a town on the coast of Peru, standing on a bay of the same name a little north of the parallel of 14° s. It carries on a large trade in sugar, guano, and brandy. In 1682 it was destroyed by an earthquake and submerged, being afterwards rebuilt farther inland. A railway from Ica passes north through Pisco to Callao and other places on the coast.

PISHIN, formerly a district of Southern Afghanistan, since 1878 forming part of British India; area, about 3600 square miles. It consists of a plain surrounded on three sides by hills, the latter rising to the height of about 11,000 feet, while the general height of the plain is 5000 feet. The people live mostly either by pasturage or by agriculture, and are generally peaceable and well-disposed. A certain amount of transit trade passes through the country from India to Afghanistan, and as the meeting-place of a number of routes leading from Sind and the Punjab to Candahar the strategic value of Pishin is considerable. It was occupied by the British in 1878, and assigned to them by the treaty of Gandamak in 1879. Pop. about 60,000.

PISTILLIDIUM, an organ of cryptogamic plants, which seems to have functions analogous to those of the pistil of a phanerogamous flower. In the case of the higher cryptogams it is commonly spoken of as an *archegonium*, whilst in the Thallophytes the female organs receive various names according to their special character. Such names are *archicarp*, *procarp*, *oogonium*, *carpogone*, *oosphere*, &c.

PISTON, in machinery, a movable piece, generally of a cylindrical form, so fitted as to occupy the sectional area of a tube, such as the barrel of a pump or the cylinder of a steam-engine, and capable of being driven alternately in two directions by pressure on either of its sides. One of its sides is fitted to a rod, called the *piston-rod*, which it either moves backwards and forwards, as in the steam-engine, where the motion given to the piston-rod is communicated to the machinery, or by which the piston is itself made to move, as in the pump. The piston is usually made to fit tightly by some kind of material used as *packing*, the piston-rod being also made similarly tight by material closely packed in the *stuffing-box*. See PUMP, STEAM-ENGINE.

PIT AND GALLOWS, in feudal times, a privilege granted to barons by the crown, in virtue of which they were empowered to hang on a gallows men convicted of theft or other crimes, and to drown in a pit or well women guilty of those crimes.

PITCAIRN, ROBERT, a Scottish antiquary, was born in 1793 at Edinburgh, and died there on July 11, 1855. He was apprenticed to a writer to the signet, was himself admitted a member of the society of writers to the signet (a class of solicitors), and became a clerk in the register-house at Edinburgh. In 1829-33 appeared his elaborate and valuable *Trials and other Proceedings in Matters Criminal*

before the High Court of Justice in Scotland, one of the publications of the Bannatyne Club, a work in four vols. quarto. Another work by him was on the families of the name of Kennedy.

PITCH-BLENDE, a mineral chiefly found in Saxony and Cornwall, composed of 86·5 oxide of uranium, 2·5 black oxide of iron, galena, and silic. In colour it varies from brown to black, and occurs globular, reniform, massive, disseminated, and pulverulent. Specific gravity, 7·5. It generally accompanies uranite.

PITCH-PINE. See **PINE**.

PITCHURIM-BEANS, the name given to the lobes of the drupe of *Nectandra puchury*, a South American species of laurel, used by chocolate makers as a substitute for vanilla. Another tree of the same genus yields a valuable timber, for which see **GREENHEART**.

PITMAN, SIR ISAAC, inventor of a well-known system of phonography, son of a cloth manufacturer, was born at Trowbridge, in Wiltshire, on Jan. 4, 1813. He was educated in the grammar-school of his native town, and in 1831 he was trained for the teaching profession in the British and Foreign School Society's college at Borough Road, London. For four years, 1832-36, he was in charge of a school at Barton-on-Humber, in Lincolnshire, and from there he went to Wotton-under-Edge, in Gloucestershire, to found a new school, from which he was dismissed in 1837 because he had joined the New Jerusalem or Swedenborgian Church. From 1839 till 1843 he conducted a private school at Bath. In 1837 he issued his work on Stenographic Sound-Hand, in which the main outlines of his phonography were set forth, and a second improved edition appeared in 1840 with the title Phonography, or Writing by Sound, being also a New and Natural System of Short Hand. A still further improved edition followed at the end of 1840, and later editions with progressive improvements were published down till 1867, when the twelfth issued from the press. His other shorthand works include The Teacher, an elementary book; The Reporter, a more advanced work; and editions of the Bible and many standard works in phonographic characters. Pitman's system soon began to displace all other systems of shorthand in English-speaking countries, and is now all but universally used for shorthand writing in the English language. It has been adapted to many foreign languages. Pitman also devoted much time and energy to the advancement of spelling reform on a phonetic basis, and in 1847 the Phonetic Institute was founded at Bath as the head-quarters for the spread of phonography and phonetic spelling. In 1887 the jubilee of phonography was celebrated in London, and in 1894 the aged inventor was knighted. He died at Bath on Jan. 22, 1897. See the biography by T. A. Reed (1890).

PITON-BARK. Same as Caribbee-Bark (which see).

PITTA. See **ANT-THRUSH**.

PITTENWEEM, a parliamentary, royal, and municipal burgh of Fifeshire, Scotland, on the Firth of Forth, 10 miles south-east of St. Andrews, with a considerable fishing industry. It contains ruins of an old priory. Pop. (1891), 1962; (1901), 1859.

PITTSTON, a town of the United States in Pennsylvania, on the river Susquehanna, 8 miles north-east from Wilkesbarre, in an important coal district. It has many manufacturing establishments, and was named after William Pitt. Pop. (1890), 10,302.

PITUITARY GLAND, a small body situated towards the base of the brain. The name, derived from the Latin *pituita*, phlegm, was given to it

because it was supposed to discharge phlegm or mucus down the nostrils. Like the pineal gland, very little is known about its function.

PIURA, a town of Northern Peru, capital of province of same name, connected by railway through Sullana with its port, Payta. It stands in an important petroleum district. Pop. 7000.

PLACENTIA. See **PIACENZA**.

PLACENTITIS, inflammation of the placenta, a disease which occurs acute or chronic, more frequently the latter. It may result from a blow, fall, fright, sudden and violent emotion, and other serious shocks to the system. The fœtus is injuriously affected, and may be destroyed by it; abortion frequently results, and at almost all stages of pregnancy.

PLAGIOCLASE. See **FELSPAR**.

PLAINFIELD, a city of Union county, New Jersey, on Green Brook, 24 miles w.s.w. of New York. It is a favourite residential city, and has manufactures of printing-presses, machine-tools, oil-cloth, and carpets. Pop. (1890), 11,267.

PLANCHÉ, JAMES ROBINSON, an English dramatist and miscellaneous writer, was born in London on Feb. 27, 1796, and died at Chelsea on May 30, 1880. At the age of fourteen he was articled to a bookseller, and shortly afterwards he became an amateur actor. He came forward early as a writer of pieces for the theatre, and in 1830 he became manager of the Adelphi Theatre. He also occupied himself with archæology, heraldry, &c., being appointed a pursuivant in the heralds' college, and latterly Somerset herald (1866). He wrote a vast number of extravaganzas, pantomimes, and other light pieces, while among his more serious productions were: History of British Costume (1834); Introduction to Heraldry (18th ed., 1866); The Pursuivant at Arms, a treatise on heraldry (1852); Recollections and Reflections (1872); The Conqueror and his Companions (1874); The Cyclopædia of Costume (1876-79).

PLANCHETTE, a thin heart-shaped piece of wood supported on two castors at the ends of the base and on an ordinary pencil at the apex. If the finger-tips be placed upon the instrument the pencil may readily be made to trace characters even without conscious movement on the part of the operator. When used by some persons it seems to begin to move of its own accord after a little space of time, and if the person wishes, for instance, to have an answer to a certain question, writing may be formed on the sheet of paper on which the instrument is placed, containing something more or less pertinent to the matter—but probably never anything that is not more or less consciously in the operator's mind. It has figured much in spiritualistic seances.

PLANTAGINEÆ, or **PLANTAGINACEÆ**, the plantains, a small natural order of plants belonging to the gamopetalous dicotyledonous series. It consists of herbaceous, rarely suffrutescent, plants, with alternate or radical, rarely opposite, leaves, and inconspicuous flowers on scapes arising from the lower leaves. The rib-grass or rib-wort (*Plantago lanceolata*), the root and leaves of which were formerly used in medicine as astringents, is a common type found all over Europe. Another genus of the order is *Littorella*, represented in Britain by *L. lacustris*, a pretty little plant with long stamens and small white flowers, found growing on the margins of pools. It flowers in July. See also **PLANTAIN**.

PLASMA, a siliceous mineral of a green colour, which, especially in ancient times, was used for ornamental purposes. It occurs in angular pieces associated with chalcedony. In biology the word denotes the simplest form of organized material,

and is used specially of the colourless fluid in which the blood-corpuscles float.

PLASTIC CLAY, in geology, a name given to one of the beds of the Eocene period from its being used in the manufacture of pottery. It is a marine deposit. See **GEOLOGY**.

PLATEAU. See **TABLE-LAND**.

PLAYFAIR, LYON, BARON, man of science and politician, was born at Chanar, in India, on May 21, 1818, his father being inspector-general of hospitals in Bengal. Educated at the parish school and university of St. Andrews, he studied chemistry under Graham in the Andersonian College in Glasgow, and began, but did not complete, the medical course at Edinburgh. After a brief period as a clerk in Calcutta he became laboratory assistant to Graham in University College, London, and in 1840 he graduated Ph.D. at Giessen, where he studied chemistry under Liebig. In 1841-42 he had charge of the chemical department of a calico-printing firm, and from 1842 till 1845 he was honorary professor of chemistry in the Royal Institution at Manchester. In the latter year he was appointed chemist to the Geological Survey, and soon afterwards he became professor of his subject in the School of Mines. For his valuable services as a special commissioner and member of the executive of the 1851 exhibition he was created a C.B., and in 1853 he was chosen secretary for science to the newly-formed Science and Art Department, becoming in 1855 secretary to the whole department. He resigned this post in 1858 to become professor of chemistry at Edinburgh, a post which he held till 1869. His political career began in 1868 with his election to the House of Commons as member for the Universities of Edinburgh and St. Andrews, which he represented till 1885, when he was elected for South Leeds. He became postmaster-general under Gladstone in 1873, and in 1880-83 he was chairman and deputy-speaker of the House. On his resignation of the latter office he was created K.C.B. He was vice-president of the council (minister for education) for a short period in the Liberal ministry of 1886, and in 1892 he was raised to the peerage as Baron Playfair of St. Andrews. He was made G.C.B. in 1895, and died in London on May 29, 1898. Playfair served on many royal commissions and other similar bodies, and did much for the advancement of technical and scientific education and sanitary science. He was president of the Chemical Society in 1857-59 and of the Aberdeen meeting of the British Association in 1885. See the *Memoirs and Correspondence* by Sir Wemyss Reid (1899).

PLEISTOCENE (Gr. *pleistos*, most, and *kainos*, recent), in geology. See **GEOLOGY**.

PLENIPOTENTIARY, an ambassador appointed with full power to negotiate a treaty or transact other business. See **MINISTERS**.

PLEURISY-ROOT. See **BUTTERFLY-WEED** in **SUPP.**

PLIOCENE (Gr. *pleion*, more, *kainos*, recent), a geological term. See **GEOLOGY**.

PLUMBAGINACEÆ, PLUMBAGINÆÆ, a natural order of gamopetalous dicotyledonous plants, consisting of (chiefly maritime) herbs, somewhat shrubby below, with alternate leaves, and regular pentamerous, often blue or pink flowers. As garden plants nearly the whole of the order is much prized for beauty, particularly the *Staticeæ*, of which one species, the Sea-Lavender (*S. Limonium*), is found wild on sandy coasts in some parts of Britain. The common thrift or sea-pink (*Armeria maritima* or *vulgaris*), with grass-like leaves and heads of bright pink flowers, is a familiar example. Some of the species of *Armeria* make good edgings for garden-

plots, &c. The type of this order is the genus *Plumbago*. It consists of perennial herbs or undershrubs, with pretty blue, white, or rose-coloured flowers in spikes at the ends of the branches. *P. europæa* is employed by beggars to raise ulcers upon their bodies to excite pity. Its root contains a peculiar crystallizable substance which gives to the skin a lead-gray colour, whence the plant has been called *leadwort*.

PLUMMET, PLUMB-LINE, a leaden or other weight let down at the end of a cord to regulate any work in a line perpendicular to the horizon, or to sound the depth of anything. Masons, carpenters, &c., use a plumb-line fastened on a narrow board or plate of brass or iron to judge whether walls or other objects be perfectly perpendicular, or *plumb* as the artificers call it. Near a range of high mountains the plumb-line, as can be shown by special arrangements, is not perfectly true, but inclines towards the mountains; and officers in charge of the United States Coast and Geodetic Survey among the Hawaiian Islands, have recently observed that the deviation of a plumb-line from the vertical is greater in the case of mountains in an island than in continental mountains, and greater in the neighbourhood of extinct volcanoes than in that of active volcanoes. In given localities the plumb-line also varies according to the ebb and flow of the tide.

PLUMPTRE, EDWARD HAYES, theologian, was born in London on Aug. 6, 1821. He entered University College, Oxford, where he graduated B.A. (double first class) in 1844, and M.A. in 1847. He was then appointed, successively, chaplain at King's College, London (1847), professor of pastoral theology there (1853), and professor of exegesis there in 1864. He was also appointed prebendary of St. Paul's, London (1863), rector of Pluckley, Kent (1869), and vicar of Bickley, Kent, in 1873. He was engaged during the years 1869-74 as one of the revisers of the authorized version of the Bible; and he was also select preacher at Oxford (several times), Boyle lecturer (1866-67), Grinfield lecturer on the Septuagint at Oxford (1872-74), examiner in the school of theology at Oxford (1872-73), and principal of Queen's College, Harley Street (1875-77). He was appointed Dean of Wells in 1881, a position which he held until his death on 1st February, 1891. He wrote a number of valuable works chiefly on theology, and contributed largely to the reviews and religious periodicals, as well as to commentaries on the Bible and various works of reference. Among his published works are: *Sermons at King's College* (1859); *Lazarus and other Poems* (1864); *Master and Scholar*, another book of verse (1866); *Christ and Christendom* (the Boyle lectures published in 1867); an excellent verse Translation of Sophocles (1865), and a similar one of Æschylus (1868); *Biblical Studies* (1870); *The Law of Progress in Theology* (1876); *St. Paul in Asia* (1877); *An Exposition of the Epistles to the Seven Churches of Asia* (1877); *Movements in Religious Thought: Romanism, Protestantism, Agnosticism* (1879); *Theology and Life* (1884); *Things New and Old* (1884), a volume of verse; *The Spirits in Prison* (1884); a verse translation of the *Commedia* and *Canzoniere* of Dante (1886-87); *Wells Cathedral and its Deans* (1888); and a *Life of Thomas Ken*, Bishop of Bath and Wells (1888).

PLUMULE, in botany, that part of the seed which grows into the stem and axis of the future plant. In the seeds of the bean, horse-chestnut, &c., the plumule is distinctly visible, but in plants generally it is scarcely perceptible without the aid of a magnifying glass, and in many it does not

appear till the seed begins to germinate. The first indication of development is the appearance of the plumule, which is a collection of feathery fibres bursting from the enveloping capsule of the germ, and which proceeds immediately to extend itself vertically upwards.

PLUTONIC ROCKS, unstratified crystalline rocks, such as granites, greenstones, and others, of igneous origin, formed at great depths beneath the surface of the earth. They are distinguished from those called volcanic rocks, although they are both igneous; plutonic rocks having been elaborated in the deep recesses of the earth, while the volcanic are solidified at or near the surface. See **GEOLOGY**.

PLYMOUTH, the capital of Montserrat, West Indies, situated on the south-west coast. It trades in sugar and lime-juice. Pop. (1901), 1461.

PLYMOUTH, a growing American town, in Lucerne county, Pennsylvania, on the Susquehanna river, 4 miles south-west of Wilkesbarre. Coal-mining is extensively carried on. Pop. (1890), 9344.

PNEUMATIC CURE, a mode of treatment practised with no little success as a remedy for certain diseases, especially emphysema, bronchial catarrh, and asthma. It consists in causing the patient to breathe the condensed atmospheric air instead of air at the ordinary pressure, the consequence of which is that the difficulty of breathing is reduced, and the most delicate air-passages of the lungs can be inflated with much more ease than in the open air.

PNEUMOTHORAX, an accumulation of air in the cavity of the pleura, produced by wounds, openings in the lungs, &c. Difficulty of breathing is its chief result.

PNOM-PENH, the chief town of Cambodia, at the apex of the delta of the Mekong. Near it are important factories for shelling cotton-seeds. Pop. 50,000.

POCKLINGTON, a market town of England, in Yorkshire (East Riding), 13 miles east by south of York, with an ancient church of considerable interest, public library, grammar-school, &c. It carries on brewing, malting, corn-milling, and the manufacture of agricultural implements. Pop. (1891), 2577; (1901), 2463.

PODARGUS, a genus of Australasian nocturnal birds of the goatsucker family. Like the goatsuckers their mouths have a very wide gape. By day they are excessively drowsy. Their food consists of insects which they seize on trees. There are several species, one of which, Cuvier's podargus (*P. Cuvieri*), is known among the Australian settlers by the name of 'mopoke', or 'more pork', from its strange cry (but this name seems more properly to belong to an owl). It is also known as a *froy-mouth*.

PODICEPS, or **PODICIPES**. See **GREBE**.

PODURIDÆ, a family of apterous (wingless) insects belonging to the order Thysanura, distinguished by the possession of an elastic forked caudal appendage, which is folded under the body when at rest, and by the sudden extension of which they are enabled to effect considerable leaps; hence their popular name of spring-tails. The number of species of *Podura* is very large. Their scales are favourite test objects for microscopes. See **SPRING-TAILS**.

POGGE, same as *Menhaden* (which see in **SUPP.**).

POINTED ARCHITECTURE, a name for the Gothic styles (which see under **ARCHITECTURE**).

POINTE-DES-GALETs, a port on the French island Réunion (see **BOURBON**), 11 miles south-west of St. Denis, the capital. It is a station on the railway running round the greater part of the coast.

POISON IVY, or **POISON OAK** (*Rhus Toxicodendron*), a trailing or climbing shrub of the order

Terebinthaceæ, found in Canada and the United States. See **SUMACH**.

POISON-NUT, a name for *Strychnos nux-vomica*, an evergreen tree of the natural order Loganiaceæ, the seeds of which yield strychnina. (See **NUX-VOMICA**.) It is also a name for the *Tanghinia venenifera*, of the natural order Apocynaceæ, the fruit of which is a drupe inclosing a kernel extremely poisonous. It used to be employed in Madagascar as an ordeal-test of guilt or innocence, the result generally being the death of the suspected person.

POISON OAK. See **POISON IVY** in **SUPP.**

POISONOUS PLANTS. Some of the botanical orders, such as the Cruciferae, contain no poisonous species at all, whilst in others, such as Solanaceæ and Euphorbiaceæ, the proportion of poisonous species is very large. Between these two extremes fall many important orders, such as Compositæ and Leguminosæ. The chief British narcotic vegetable poisons are those derived from the plants Monkshood or Wolf's-bane; Deadly Nightshade, Belladonna, or Dwale; Henbane; and Thorn-Apple, Devil's Apple, or Jamestown Weed. The first of these (*Aconitum Napellus*) belongs to the order Ranunculaceæ. It has deep-cut leaves like those of the common buttercup; peculiar, blue, helmet-like flowers; and roots much resembling horse-radish. The whole plant is intensely poisonous owing to the presence of an alkaloid known as *aconitin*; it produces a tingling in the mouth and afterwards throughout the body, followed by faintness, diminished respiration, weakened beating of the heart, dimness of sight, and deafness, possibly convulsions, and finally death from prostration. The chief antidotes are atropin, belladonna, and digitalis. The Deadly Nightshade (*Atropa Belladonna*), of the order Solanaceæ, with dull purplish flowers, large simple opposite leaves, and dark smooth berries of the size of cherries closely set in the persistent calyx, owes its poisonous properties, which are inherent in all parts of the plant, to the active principle *atropin*. The first effects of the poison are dryness and heat in the throat accompanied by great thirst, a flushed countenance, and very great dilation of the pupil of the eye. Delirium, loss of muscular power, convulsions, and stupor ensue. Physostigmin, the principle in the Calabar Bean, is employed as an antidote, and stimulants should be freely given. Very similar are the symptoms of poisoning by the common henbane (*Hyoscyamus niger*), a hairy annual or biennial of the same family, with lobed sessile leaves, and dull yellow solitary axillary flowers. Another solanaceous plant yielding a narcotic poison is the Thorn-Apple (*Datura Stramonium*), a native of India, naturalized on rubbish-heaps in some parts of Britain. It has rather large, toothed leaves with a marked smell, and large, white, trumpet-like flowers. Poisoning in this case is mostly due to eating the leaves or the seeds; its symptoms and treatment are the same as for dwale. All these poisonous principles are employed in medicine in various forms, but they should not be used by inexperienced persons.

A considerable number of common British plants contain irritant or narcotico-irritant poisons. Among these is the Cuckoo-Pint, Lords-and-Ladies, or Wake-Robin (*Arum maculatum*), a plant of the natural order Araceæ common in shady woods. It has arrow-shaped leaves, and its inflorescence is a fleshy spadix surrounded by a large leafy spathe. The spathe falls away later and exposes a tempting cluster of bright-red fruits. It irritates the mouth, stomach and bowels, and produces vomiting, followed later by convulsions, insensibility, and death. Castor-oil, hot coffee, and various stimulants should be administered, and the abdominal pains relieved by

warm poulticing. Several well-known members of the order Umbellifera contain a poison which begins by producing great weakness in the lower limbs, accompanied by sickness and burning in the mouth and throat. The pupils of the eyes dilate and the upper lids close over the balls of their own accord. Paralysis ensues, and finally death from failure of breathing. These include the common or spotted hemlock (*Conium maculatum*), with much-divided leaves, nauseous when bruised, spotted stem, and many-rayed umbels with a general involucre and one-sided involucre; the water hemlock (*Cicuta virosa*), a less common plant growing in moist places, with a large, white, fleshy rootstock, bi- or tripartite leaves with longish, toothed segments, many-rayed umbels usually without a general involucre but with partial involucre; the hemlock water dropwort (*Eranthis crocata*), with decoupled leaves having broad segments, parsnip-like roots, and many-rayed umbels generally without a common involucre; and the Fool's Parsley (*Aethusa Cynapium*), characterized by its much-divided leaves and one-sided involucre of long, narrow bracts. Among antidotes for these poisons are oak bark decoction, tannic and gallic acids; and hot tea or other similar substances should be given. Tincture of belladonna is used to maintain respiration. The Meadow Saffron (*Colchicum autumnale*), a crocus-like plant of the lily order, with delicately-tinted flowers appearing in autumn and followed later by sword-shaped leaves, acts as an irritant on the intestines and produces vomiting, accompanied by prostration, profuse perspiration, and involuntary twitchings. The antidotes are the same as for hemlock, but white-of-egg drink, gum-water, barley-water, &c., should be given to soothe the irritation of the stomach. The Woody Nightshade or Bittersweet (*Solanum dulcamara*) has black berries which act in a similar way, leading to convulsions and delirium. Castor-oil, various stimulants, &c., are prescribed in addition to the emetics to be employed in all cases. The berries of the common privet (*Ligustrum vulgare*), a shrub of the order Oleaceæ, with opposite, entire, ovate-lanceolate leaves and panicles of small white flowers, and the berries and leaves of the common yew-tree (*Taxus baccata*) have also produced deaths, chiefly of children. Stimulants and emetics should be given, and the warmth of the body should be maintained by friction or other means. The well-known foxglove (*Digitalis purpurea*), of the order Scrophulariaceæ, with alternate, downy, ovate-lanceolate leaves tapering into the foot-stalks, and stately racemes of large, irregularly tubular, spotted red flowers, owes its poisonous character to a powerful principle *digitalin*. Sickness, vomiting of greenish matter, abdominal pains and purging, faintness, paleness and sweatiness of the skin, suppression of urine, and stupor are among the symptoms of its action. Tincture of aconite is an antidote; it should be used with various stimulating drinks, and a recumbent position should be maintained. Other plants known in Britain and acting as irritant or narcotico-irritant poisons are the Cypress Spurge (*Euphorbia Cyparissias*), the Pasque-Flower (*Anemone Pulsatilla*), the Mezereon (*Daphne Mezereum*), the Herb Paris (*Paris quadrifolia*), and Laburnum (*Cytisus Laburnum*). The chief exotic poisonous plants are noticed in separate articles; they include the Opium Poppy (*Papaver somniferum*), Calabar Bean (*Physostigma venenosum*), Indian Hemp (*Cannabis Indica*), Nux-vomica (*Strychnos nux-vomica*), Cocculus Indicus (*Anamomi Cocculus*), the Hellebores (*Veratrum album* and *viride*), Indian Tobacco (*Lobelia inflata*), Pokeberry (*Phytolacca decandra*), Tobacco (*Nicotiana Tabacum*), and the Virginia Creeper (*Ampelopsis quinquefolia*).

The mushrooms require special consideration in this connection, because of the great difficulty experienced by non-specialists in distinguishing edible from poisonous species. No absolutely definite rules can be laid down, for it would seem that much depends on the particular constitution of the individual concerned and on the conditions under which the plants have been grown. One person may eat with advantage, or at least impunity, species which would do serious injury to another, and it is said that even the common mushroom of our autumn fields (*Agaricus campestris*) is regarded with suspicion in the south of Europe. Some general principles, mostly liable to exception, may, however, be stated to guide in the choice of wholesome, and the avoidance of unwholesome species. The edible kinds mostly grow solitarily in dry, airy places, while poisonous varieties grow in clusters in woods and damp, dark places; *Cantharellus cibarius*, the Chanterelle, an edible species, is, however, found in woods. Bright-coloured species should be avoided (here again the yellow chanterelle is an exception), especially the fly agaric (*Amanita muscaria*), with its bright-red cap, studded with little protuberances. White and brown are the prevailing colours in edible species, which also have the flesh compact and brittle, and not tough, soft, or watery, as in most unwholesome kinds. Those that change colour when cut or broken should be avoided, and also those with milky juice (*Lactarius deliciosus* is a notable exception); edible forms usually have the juice watery. *Coprinus comatus* is an exception to the rule that deliquescent species should be passed over. The odour of wholesome species is usually agreeable, and of most poisonous species, pungent and repulsive. Most species with a bitter, acrid, salt, or astringent taste are unwholesome. The fly agaric owes its poisonous properties to a principle called *muscarin*, which produces irritation of the stomach and bowels and also affects the brain. Sickness, faintness, dimness of sight, prostration, and stupor are among the chief symptoms, which may appear at once or not till some time after the fungus has been eaten. An emetic, such as mustard and water, should be administered; or the throat should be tickled with a feather, &c. Belladonna acts as an antidote, and also *digitalin*.

POKER, a card game which seems to have originated in the United States, and of which there are several varieties, the most common being *draw-poker*, played with a pack of fifty-two cards and any number of players. The game begins by the dealer staking a sum agreed on, called the *ante*, after which he deals five cards to each person. Each then successively looks at his cards, beginning on the left of the dealer, and according to their value he may either throw up his hand or play, in the latter case putting double the ante into the pool. The dealer who looks at his hand last may in like manner either 'go out of the game', or 'make good' his ante by adding enough to double it. The dealer then asks those who are to play if they wish to 'fill their hands', that is, receive one or more cards from the pack in exchange for others discarded, or if they will play their original hand. When this is arranged the players, beginning with the one on the left of the dealer, have the 'say' as to whether they will now go out of the game and lose their stakes or 'raise', that is, add a sum to that already staked. When any one agrees to raise, the next in succession must declare whether he is to go out of the game; 'see the raise', that is, add an amount equal to that just added by the previous player; or 'go better', that is, add more than an equivalent. This goes on till either all are out but one, who accordingly takes

the stakes, or several are left in who all 'have seen the raise' but not 'gone better'. In this latter case the hands have to be shown, and the holder of the best hand takes the pool. The most valuable hand is when a player has a sequence of five cards of the same suit, called a 'straight flush', the absolutely best hand being the sequence of ace, king, queen, knave, ten. The hands next after a straight flush in descending value are: 'fours', or four cards of the same rank and another card; a 'full', or three cards of the same rank with other two forming a pair; a 'flush', that is, five cards of the same suit not in sequence; a 'straight', or sequence of five cards of more than one suit; 'triplets', three cards of the same rank and other two not forming a pair; a pair, with other three cards of different ranks; lastly, the highest card. The cards rank in value as at whist, except that the ace may be the highest or lowest card in a straight.

POKEWEED, the *Phytolacca decandra*, a North American branching herbaceous plant of the order Phytolaccaceæ, which is naturalized in some parts of Europe and Asia. It has large leaves, sometimes purplish in colour, and long erect racemes of flowers, succeeded by fine bunches of black berries. Its root acts as a powerful emetic and cathartic, but its use is attended with narcotic effects. Its berries are said to possess the same quality; they are employed as a remedy for chronic and syphilitic rheumatism, and for allaying syphilitic pains. The leaves are extremely acrid, but the young shoots, which lose this quality by boiling in water, are eaten in the United States as asparagus. It is also known as the Red-Ink plant from the appearance of the juice of its berries. Several other species are used for various purposes: among these are *P. iosandra*, *P. dodecandra*, and *P. octandra*, distinguished botanically from one another and from pokeweed mainly, as the specific names indicate, by the number of their stamens.

POLAR CIRCLES, two imaginary circles of the earth parallel to the equator, the one north and the other south, distant $23^{\circ} 28'$ from either pole. The the surfaces inclosed by these circles are known as *frigid zones*. See under **ARCTIC**.

POLAR DISTANCE, the angular distance of any point on a sphere from one of its poles; more especially, the angular distance of a heavenly body from the elevated pole of the heavens. It is measured by the intercepted arc of the circle passing through it and through the pole, or by the corresponding angle at the centre of the sphere. According as the north or south pole is elevated we have the *north polar distance* or the *south polar distance*. The sum of the two polar distances of any point is obviously 180° .

POLAR EXPEDITIONS. See **NORTH POLAR EXPEDITIONS** and **SOUTH POLAR EXPEDITIONS**.

POLARISCOPE. See **POLARIZED LIGHT**.

POLARITY, that quality of a body in virtue of which peculiar properties reside in certain points called poles; usually, as in electrified or magnetized bodies, properties of attraction or repulsion, or the power of taking a certain direction; as the *polarity* of the magnet or magnetic needle, whose pole is not that of the earth, but a point in the Polar Regions. A mineral is said to possess *polarity* when it attracts one pole of a magnetic needle and repels the other.

POLEMONIACEÆ, a natural order of gamopetalous dicotyledons with a trifid stigma, three-celled fruit, and seeds attached to an axile placenta, the embryo lying in the midst of albumen. They consist for the most part of gay-flowered herbaceous plants, natives of temperate countries, and particularly abundant in the north-western parts of America.

They are of no economical importance. Some are cultivated for their beauty, especially the well-known phloxes. *Polemonium ceruleum*, known as Greek valerian or Jacob's ladder, is the only British species, being found chiefly in northern England.

POLEMOSCOPE, a sort of stand or frame high enough to rise above a parapet or other similar object, having a plane mirror at top so fitted as to reflect any scene upon another mirror below, and thus enable a person to see a scene in which he is interested without exposing himself. The name is derived from its possible use in war (Gr. *polemos*, war, and *skopein*, to observe, to see).

POLIANTHES, a genus of plants belonging to the natural order Amaryllidaceæ. They are natives of the East Indies and South America, and in Britain require the aid of artificial heat, under shelter of frames and glasses, to bring them to flower in perfection. The *P. tuberosa* or *tuberosa* is well known for its delicious fragrance. See **TUBEROSE**.

POLICE BURGH. See **BURGH**.

POLIGNANO, an Italian town in the province of Bari, on the Adriatic, 26 miles E.S.E. of Bari, on the Bari-Brindisi railway. There is a trade in lemons and oranges. Pop. 8000.

POLILLO, one of the Philippine Islands, E. of Luzon; length, 30 miles; breadth, 20 miles. It is crossed by the parallel through Manila, and is of a roughly triangular shape.

POLLANARRUA, a ruined city and formerly capital of Ceylon, situated about 60 miles N.E. of Candy. There are numerous large stone figures of Buddha, and remains of temples and other buildings. It flourished from the eighth to the beginning of the thirteenth century. It is now called Topare.

POLLOCK, SIR FREDERICK, English jurist, eldest son of Sir William Frederick Pollock, Bart., was born in London on Dec. 10, 1845. He was educated at Eton and at Trinity College, Cambridge, of which he became fellow in 1868. In 1871 he was called to the bar at Lincoln's Inn, and in 1882-83 he was professor of jurisprudence in University College, London. Since 1883 he has occupied the chair of jurisprudence at Oxford, and during the period 1884-90 he was professor of common law in the Inns of Court. He was a member of the Royal Commission on Labour in 1891-94. Since 1895 he has been editor of the Law Reports. In 1888 he succeeded his father in the baronetcy. Among his published works are: *The Principles of Contract* (1876; 6th ed., 1895); *Digest of the Law of Partnership* (1877; 7th ed., 1900); *Spinoza, his Life and Philosophy* (1880; 2nd ed., 1899); *The Law of Torts* (1883; 5th ed., 1897); *The Land Laws* (English Citizen Series, 1883; 3rd ed., 1895); *Introduction to the History of the Science of Politics* (1890; 3rd ed., 1900); *Oxford Lectures and other Discourses* (1890); *Leading Cases done into English, and other Diversions* (1892); *The Law of Fraud, &c., in British India* (Tagore Law Lectures, 1894); *A First Book of Jurisprudence* (1896); *The Etchingham Letters* (1899; with E. F. Maitland); and others. With F. W. Maitland he wrote a *History of English Law* before Edward I. (1895; 2nd ed., 1899).

POLO, a ball game played on horseback, of Eastern origin, but now practised in England, America, and elsewhere. It may be briefly described as hockey on horseback, the players being furnished with polo-sticks about 4 feet long, with a cross-piece on the striking end, and the object being for one set of players to drive the ball through the goal of the opposite side. All the players are mounted on ponies, which require to be specially trained for the purpose, and there must be a specially-prepared piece of ground consisting of an oblong grassy area, say 300

yards long by 200 broad. There is a goal-keeper at either end as in football, and the goals are formed by upright posts, between which the ball has to be driven. The players may number from three to six on each side, but the proper number is considered to be four. The game is played in several parts of the East, the most enthusiastic devotees of it being the people of Manipur, on the borders of Assam. (See MANIPUR.) The game was introduced into Britain in 1871 by officers who had been stationed in India.

POLYDIPSIA, a term applied to diabetes (which see).

POLYEMBRYONY, in botany, a phenomenon occurring, sometimes regularly and sometimes abnormally, in the development of the ovules of flowering plants, consisting in the existence of two or more embryos in the same seed. It is not infrequent in the genera *Allium* and *Funkia* and in the orange, and it is the rule in most gymnosperms.

POLYGALA, a genus of plants of the natural order Polygalaceæ. The species abound in milky juice, and are found in most parts of the world. The root of *P. Senega* (senega or seneca root or Virginian snake-root) is a stimulating diuretic, useful in pneumonia, asthma, and rheumatism. *P. vulgaris*, or milkwort, is a British plant, common in dry pastures. Some of the species have cleistogamous flowers. See MILKWORT in SUPP.

POLYGALACEÆ, a natural order of herbs or shrubs, belonging to the polypetalous section of the dicotyledons, with alternate, exstipulate, simple leaves; irregular hermaphrodite flowers; diadelphous or monadelphous stamens; anthers opening at the apex by a pore or chink. Nearly half the species are comprised in the genus *Polygala*, and are very generally distributed. The plants of this order are mostly bitter, and acrid or astringent. Besides the type-genus, which is the only British one, this order includes *Securidaca*, and probably also the somewhat doubtful *Trigonia*, which some make the type of a separate order and others class with the Leguminosæ. *Krameria*, a still more anomalous genus, is often referred to the milkwort order; some, however, regard it as a leguminous genus, and still others constitute an order Krameriaceæ.

POLYGON (Greek, *polys*, many, *gōnia*, an angle), in geometry, a plane figure of many angles and sides, or at least of more than four sides. A polygon of five sides is termed a *pentagon*; of six sides, a *hexagon*; of seven sides, a *heptagon*; and similarly we have *octagon* (8), *nonagon* (9), *decagon* (10), *enneagon* (11), and *dodecagon* (12). Polygons of more than twelve sides do not usually receive single-worded names. *Similar polygons* are those which have their several angles equal each to each, and the sides about their equal angles proportionals. All similar polygons are to one another as the squares of their homologous sides. If the sides are all equal and the angles are likewise all equal, the polygon is said to be regular; otherwise, it is irregular. The angle of a regular polygon of a given number of sides is a definite quantity depending only on that number. It is determined by means of a corollary to Euc. I. 32, which states that the sum of the angles of any polygon (without re-entrant angles) together with four right angles is equal to twice as many right angles as the figure has sides. Every regular polygon can be circumscribed by a circle, or have a circle inscribed in it. Polygons are treated of in the latter part of Euclid's sixth book with respect to similarity, &c., and in his fourth book with respect to their circumscribing and inscribed circles, &c.

—**POLYGON OF FORCES**. See MECHANICS.

POLYGONUM, a genus of plants of the natural

order Polygonaceæ. See BISTORT and KNOT-GRASS in SUPP.; also BUCKWHEAT and POLYGONACEÆ.

POLYHEDRON, in geometry, a body or solid bounded by many faces or planes. When all the faces are regular polygons similar and equal to each other the solid becomes a regular body. Only five regular solids can exist, namely, the tetrahedron, the hexahedron (or cube), the octahedron, the dodecahedron, and the icosahedron, having respectively 4, 6, 8, 12, and 20 faces. In the first, third, and fifth the faces are equilateral triangles; in the dodecahedron they are regular pentagons; and in the cube they are squares.

POLYPODIACEÆ, a natural order of ferns, which may be taken as the type of the whole. They are usually herbaceous plants with a permanent stem, which either remains buried or rooted beneath the soil, or creeps over the stems of trees, or forms a scarcely movable point of growth, round which new leaves are annually produced in a circle, or it rises into the air in the form of a simple stem, bearing a tuft of leaves at its apex and sometimes attaining the height of 40 feet, as in the tree-ferns. They are grouped in several tribes, namely, Polypodiæ, Pteridæ, Acrostichæ, Davalliæ, Asplenidæ, Grammatidæ, and Aspidiæ. See FERNS for the British genera.

POLYPORUS, a genus of parasitical fungi, forming the type of a family of Hymenomycetes. The *P. destructor* is one of the pests of wooden constructions, producing what is sometimes termed *dry-rot*, although the true dry-rot is a different plant (*Merulius lacrymans*). *P. ignarius* is known by the name of amadou, touch-wood, or spunk. See DRY-ROT and GEXMAN TINDER.

POLYSYNTHETIC LANGUAGES. See PHILOLOGY.

POLYTHALAMIA, a group of Protozoa occupying compound chambered cells of microscopic size. In some instances each cell of the common shell presents only one external opening, but more commonly it is punctured with numerous minute pores or foramina, through which the animal can protrude filaments. The chambers are arranged in various ways, producing the linear, spiral, turreted, and other Foraminifera. Some of the chief polythalamous genera are *Textularia*, *Discorbina*, and *Robulina*. Their remains constitute the bulk of the chalk and tertiary limestone. See FORAMINIFERA.

POLYURIA (*Diabetes insipidus*), a disease characterized by the passage of large quantities of urine of low specific gravity, but not containing any unhealthy constituents. It is a rare disease of an obscure character, and seems to be capable of transmission from parents to their children. No special treatment is known, but regulation of diet and the use of tonics may prove of advantage.

POMPELO (*Citrus Pomelo*), also known as *Pompelo*, a plant closely allied to and resembling the orange and shaddock, and sometimes regarded as merely a variety of the latter. Its fruit is sometimes called the *forbidden fruit*.

POMFRET, JOHN, English poet, was born at Luton, Bedfordshire, in 1667, and died near the end of November, 1702. Educated at Bedford Grammar School and Queen's College, Cambridge, where he graduated B.A. in 1684, he took orders, and in 1695 was made rector of Maulden in his native county, being transferred to Millbrook seven years later. He published a volume of Poems in 1699, and in the following year appeared *The Choice: a Poem written by a Person of Quality, which attained and long enjoyed great popularity*. His life was written by Dr. Johnson.

POMPELO. See POMPELO in SUPP.

PONAPE, one of the Caroline Islands (which see). It is roughly circular, with a diameter of about 16 miles, and is mountainous, well-wooded, and fertile. A coral reef, pierced in nine places, surrounds it at a distance of about 3 miles. The climate is excellent, and the chief productions are the durian and the vegetable-ivory nut. There are many curious remains on and near the island. Pop., confined to the coast districts, about 2500.

PONCE, a town of Porto Rico, West Indies, situated near the south coast. It has a very healthful climate, and is the largest place on the island after the capital. Pop. in 1899, 27,952.

PONDOLAND, a maritime territory of Cape Colony abutting on Natal, 90 miles from N.E. to S.W., and about 50 from N.W. to S.E. Pop. 166,080; area, 4040 square miles. Its vegetation is luxuriant, and it is well adapted for the rearing of cattle and sheep. The St. John's River flows through its southern part, and forms at its mouth an excellent harbour. It was the last remnant of independent Kaffraria, became a British protectorate in 1884, and was annexed to the Cape in 1894.

PONSARD, FRANÇOIS, French dramatist, was born at Vienne, in Dauphiné, on June 1, 1814, and died in 1867. His first success was his *Lucrèce*, produced in 1843, and welcomed as a return to classicism. Among his other pieces are *Agnès de Méranie* (1846); *Charlotte Corday* (1850); *L'Honneur et l'Argent* (1853); *La Bourse* (1856); and *Le Lion amoureux* (1866). He became a member of the Academy in 1855.

PONTEDERA, a town of Italy, in the province of Pisa, on the Era, not far from its mouth in the Arno. It manufactures cotton goods. Pop. 7000.

POONAC, the substance left after cocoa-nut oil is expressed from the nuts, used as manure and for feeding stock. Like *copra* (the dried kernel still containing the oil) it is now an article of commerce.

POOREE, or **PURI**, a town and district of Bengal, India, in the division of Orissa. The town is 250 miles S.W. from Calcutta. It contains the shrine of Juggernaut, to whose worship crowds flock from every part of India. (See *JUGGERNAUTH*.) Pop. (1891), 28,794.—The district has an area of 2473 square miles, and a population (1891) of 944,998.

POPERINGHE, a town in Belgium, in the province of West Flanders, close to the French border, with some trade in hops and hemp. It has manufactures of woollens, lace, linen, pottery, &c. Pop. (1894), 10,941.

PORBANDAR, a seaport and town of India, chief town of a native state of the same name, in the political agency of Kattyawar, Bombay. It is built on a creek on the S.W. coast of Gujerat, and has a brisk shipping trade with Bombay and Malabar. Pop. (1891), 18,805.—The state has an area of 535 square miles and a pop. of 85,785.

PORBEAGLE, a fish of the Lamnidae family of sharks. Three species have been described; the best known is *Lamna cornubica*, which occurs in the North Atlantic, and frequently strays to the British coasts. It attains to a length of 10 feet, and feeds chiefly on fishes. The porbeagle has two dorsal fins, a wide mouth, lanceolate teeth, and very wide gill-openings. See *SHARK*.

PORCELAIN CRAB (*Porcellana*), a name for certain crustacea, typical of the family Porcellanidae, small smooth crabs, of which two are common on the British coasts: *P. platycheles* the hairy, and *P. longicornis* the minute, porcelain crab.

PORCUPINE ANT-EATER. See *ECHIDNA*.

PORCUPINE CRAB (*Lithodes hystrix*), a species of crab covered with spines, found off the coasts of Japan. It is dull and sluggish in its movements.

PORCUPINE-FISH (*Diodon hystrix*), a fish of the order Plectognathi, found in the tropical seas. It is about 14 inches long, and is covered with spines or prickles.

PORCUPINE-GRASS (*Triodia* or *Festuca irritans*), an excessively spiny Australian grass which makes large areas almost impassable, commonly called *spinifex*. It is found in clumps of some three feet high, and is absolutely uneatable by any animal. Moreover, the prevalence of this grass is usually associated with a great scarcity of water.

PORCUPINE-WOOD, a name for the wood of the cocoa-nut palm. The markings on a horizontal section resemble those of porcupine-spines.

PORGIE (*Pugrus argyrops*), a fish of the family Sparidae, with an oblong body, scaly cheeks, and one dorsal fin, found off the coasts of the United States. It is one of the most important food fishes, and attains a length of 18 inches and a weight of 4 lbs. The name is also given to the Menhaden, which see in *SUPP.*

PORISM, a name given by ancient geometers to a class of mathematical propositions having for their object to show what conditions will render certain problems indeterminate. Playfair defined a porism thus: 'a proposition affirming the possibility of finding such conditions as will render a certain problem indeterminate, or capable of innumerable solutions'. Euclid's three books on porisms have been lost, and in consequence there has been much controversy as to what the ancients meant by the term.

PORPHYRIO, a genus of birds of the rail family, including the *P. hyacinthinus* (purple or hyacinthine gallinule), a bird found in Europe, Asia, and Africa, and remarkable for the structure of its beak and the length of its legs. It feeds on seeds and other hard substances, and lives in the neighbourhood of water, its long toes enabling it to run over the aquatic plants with great facility. It is about 18 inches long, of a beautiful blue colour, the bill and feet red. See *GALLINULE*.

PORTA. See *BACCIO DELLA PORTA*.

PORT ARTHUR, a town and port in north-eastern China, now belonging to Russia. It is situated near the southern extremity of the Liao-Tung peninsula, on the strait of Pe-Chi-li, and has a fine natural harbour which has been much improved in recent years. It is admirably adapted for defence, and the Russian authorities have erected strong fortifications around it. The port is a purely naval one for Russian and Chinese men-of-war, and is not open to commerce, but part of the port of Ta-lien-wan, to the north-east, is a free commercial port. At the time of the war between Japan and China Port Arthur was the chief Chinese naval station, but during the war, in 1894, it was occupied by the Japanese, and its docks and fortifications were destroyed. Japan was constrained, chiefly by Russian influence, to evacuate it on the conclusion of hostilities, and on Mar. 27, 1898, it was formally leased to Russia, along with Ta-lien-wan and neighbouring territory, for twenty-five years or longer according to mutual agreement. Port Arthur is the terminus of a line of railway which runs south from Kharvin on the Trans-Siberian line through Mukden, &c.

PORT BLAIR, a harbour of South Andaman Island. See *ANDAMANS*.

PORT DARWIN, an inlet on the northern coast of Australia, the chief harbour of the Northern Territory of South Australia, about 2000 miles from Adelaide. It is one of the finest harbours in Australia and has a trade with Java. The port town is Palmerston.

PORT DURNFORD, a good harbour on the

east coast of Equatorial Africa, in lat. $1^{\circ} 18' \text{ s.}$, at the mouth of the Wabusi River.

PORTER, NOAH, D.D., LL.D., an American philosopher and writer, was born at Farmington, Conn., United States, on Dec. 14, 1811. Graduating at Yale College in 1831, he was ordained pastor of the Congregational Church, New Milford, Conn., in 1836, and in 1843 settled at Springfield, Mass. Returning to Yale in 1846 as professor of metaphysics and moral philosophy, he was elected president in 1871, and continued to hold that position till 1886. Amongst his chief works are *Historical Discourses* (1840); *The Human Intellect* (1868); *Books and Reading* (1870); *The Science of Nature versus the Science of Man* (1871); *The Elements of Intellectual Philosophy* (1872); *The Elements of Moral Science* (1885); *Bishop George Berkeley* (1885); and *Kant's Ethics* (1886). Dr. Porter also edited an edition of Webster's Dictionary. He died at New Haven on Mar. 4, 1892.

PORTHCAWL, a seaport and watering-place of Wales, on the coast of Glamorganshire, 16 miles south-east of Swansea. It has a floating dock protected by a breakwater, and carries on a trade in iron-ore, pig-iron, &c. Pop. (1891), 1758; (1901), 1871.

PORTLAND BEDS, in geology, a division of the Upper Oolites occurring between the Purbeck Beds and the Kimmeridge Clay. See **GEOLOGY**.

PORT-LYTTELTON. See **LYTTELTON** in SUPP.

PORT-MOODY, a harbour at the head of Burrard Inlet, British Columbia, Canada, a little to the north of New Westminster. It was at one time intended for the terminus of the Canadian-Pacific Railway, but was abandoned for Vancouver, at the entrance to Burrard Inlet.

PORT MORESBY, the capital of British New Guinea, a village on the south coast, situated to the south-east of Redscar Bay. The neighbouring country is barren and treeless, but the climate is not unhealthy. The settlement was founded in 1873. The harbour is protected by a coral reef.

PORT NOLLOTH, a small town on the west coast of Cape Colony, situated a few miles to the south of the mouth of the Orange River. Through it passes the copper from the Ookiep mines about 100 miles inland, with which it is connected by a horse railway. These mines still furnish much metal, although they have been worked since 1863.

PORTO, same as **OPORTO** (which see).

PORTO-FERRAJO, an Italian town, chief town of the island of Elba, on the north coast. It exports iron ore. Napoleon I. resided here from May 5, 1814, to February 26, 1815. (See **ELBA**.) Pop. 4000.

PORTO NOVO, a seaport in Dahomey, to the east of Whydah.

PORTO SEGURO, a town of the German territory of Togoland on the Guinea coast, West Africa. It lies east of Bagida and south of the Togo lake, which stretches parallel to the coast at a small distance inland. The trade is chiefly in palm-oil and almonds. There is a town of the same name on the Brazil coast, south of Bahia.

PORTSLADE-BY-SEA, an urban sanitary district of England, in Sussex, 3 miles east of Brighton, with an old church (restored), and several breweries. Pop. (1891), 4097; (1901), 5217.

PORT-STANLEY, port and capital of the Falkland Islands, on Port William Inlet, on the N.E. coast of East Falkland. It exports wool, hides, seal-fur, &c. Pop. 900. See **FALKLAND ISLANDS**.

PORT TALBOT. See **ABERAVON**.

PORTUGUESE EAST AFRICA. See **EAST AFRICA (PORTUGUESE)** in SUPP.

PORTUGUESE WEST AFRICA. See **ANGOLA**.
PORT VICTOR, a seaport and sea-side resort of South Australia, on the shores of Victor Harbour, a small bight of Encounter Bay, 64 miles south of Adelaide. Extensive harbour works have recently been executed. Pop. 1800.

PORT VICTORIA, a seaport and railway terminus of England, in the county of Kent, on the north shore of the Medway estuary, about 2 miles w.s.w. of Sheerness. It is a terminus of the South-eastern Railway, and the starting-point of steamers running to the Continent.

PORT VICTORIA, the capital of the Seychelles, in the island of Mahé. Its chief exports are vanilla, copra, and cloves. See **MAHÉ**.

POSTMASTER-GENERAL, the chief executive head of the postal and telegraphic systems of Britain. He is usually a member of the cabinet, being therefore not a permanent but a political official, and he exercises authority over all the departments of the postal and telegraphic systems, including money-orders, savings-bank, insurances, and annuities.

POST-MILL, a form of wind-mill so constructed that the whole fabric rests on a vertical axis, and can be turned by means of a lever. See **WINDMILL**.

POST-TERTIARY (or **QUATERNARY**), in geology, the Lyellian term for all deposits and phenomena of more recent date than the Norwich or mammaliferous crag, now usually known as Pleistocene and Recent. See **GEOLOGY**.

POTASH WATER, an aerated water produced by mixing bicarbonate of potash with carbonic acid water in the proportion of 20 grains to each bottle of the water, or about half an ounce to the gallon. Bisulphate of potash, as being cheaper than tartaric acid, is sometimes used (but should not be) with carbonate of soda to produce the common effervescing drink. A valuable medicinal water is compounded of a certain proportion of bromide of potassium. See **AERATED WATERS**.

POTATO-BUG, a name given in America to many insects injurious to the potato, such as the Colorado beetle (which see).

POTCHEFSTROOM, a town in the Transvaal, South Africa, on the Mooi river, about 15 miles north of the Vaal river, and 100 to the south-west of Pretoria. It is a pleasant-looking little town with much verdure about it. It was founded in 1839, and up till 1863 it was the chief town of the Transvaal, and the seat of government, but Pretoria then became the capital. In 1881 a British force of 250 men held out in a small fort for a considerable time, but surrendered after a serious loss in killed and wounded. It was occupied by the British in 1900 without opposition. Pop. about 5000.

POTERIUM, a genus of plants belonging to the natural order Rosaceæ and sub-order Sanguisorbææ. *P. Sanguisorba*, or salad-burnet, which grows on dry and most frequently chalky pastures, is the only British species. It is valuable for fodder, and is used in salad. The Great Burnet, usually referred to the genus *Sanguisorba*, is sometimes called *Poterium officinale*. The generic name, from the Greek word for a drinking-cup, refers to the use of the salad-burnet in cooling drinks. See **BURNET**.

POTOROO. See **KANGAROO RAT**, of which it is the native name.

POTT, AUGUST FRIEDRICH, German philologist, was born at Nettelrede, Hanover, on Nov. 14, 1802. He studied at Göttingen, became a teacher in the gymnasium at Celle, and subsequently privat-docent in the University of Berlin (in 1830). In 1833 he was appointed extraordinary professor of linguistic science at Halle, and ordinary professor in 1839. He died at Halle on July 5, 1887. Pott's greatest work is

his *Etymologische Forschungen* (Etymological Researches; second and enlarged edition, 1859-76, six vols.). He also issued another important work entitled *Zigeuner in Europa und Asien* (The Gypsies in Europe and Asia). His other works comprise: *De Borussico-Lithuanicæ tam in Slavicis quam Leticis Linguis Principatu* (1837-1841); *Die quinare und Vigesimalen Zählmethoden bei Völkern aller Welttheile* (1847); *Die Personennamen, insbesondere die Familiennamen und ihre Entstehungsarten* (1853); &c.

POTTERIES, THE, a district of northern Staffordshire, England, head-quarters of the English earthenware and porcelain manufacture, comprising the towns of Burslem, Hanley, Stoke, Longton, Newcastle-under-Lyme, Tunstall, &c. Many thousands of people are employed in the china and earthenware industries of the district.

POTTINGER, ELDRED, British officer, famed for his defence of Herat in 1838, was born in county Down, Ireland, on August 12, 1811, and went to Bombay at the age of seventeen as artillery cadet. In 1837 he traversed Afghanistan in disguise, and reached Herat after many risks. The city was then held by an Afghan prince, and was besieged by the Persians for nearly a year, when it was relieved by a British diversion in the Persian Gulf. The credit of the defence was given to Pottinger. Major Pottinger took a leading part in the disastrous Afghan war of 1841-42, and as political agent had to sign terms with the rebels, which were afterwards repudiated by Lord Ellenborough. A trial by court-martial only served to show his conduct in brighter colours. He died on Nov. 15, 1843, at Hong-Kong.

PÖTTINGER, SIR HENRY, BART., G.C.B., a distinguished soldier and diplomatist, uncle of the above, was born in county Down, Ireland, on Oct. 3, 1789. He went to India as a cadet in 1804, and soon became known for his energy and administrative ability. In 1809 he and a friend offered to explore the country between India and Persia with a view to obtaining information important to the government. Their offer was accepted, and on the second day of the following year they set out, travelling by way of Sind to Kelat and Nuahki. Here they separated, Pottinger going through Kirman and Shiraz to Ispahan, where they again met. The story of this journey is told in his *Travels in Beloochistan and Sind* (1816). He subsequently served in the Mahratta war and held various posts, including that of political agent in Sind (1836-40). Rising gradually to the rank of major-general, he was, after the Afghan campaign in 1839, raised to the baronetage as a reward for his services. In 1841 he went as minister-plenipotentiary to China, and by his resolute determination contributed much to bring hostilities to a satisfactory conclusion. The war was concluded by the Nanking treaty, under which Britain received Hong-Kong and secured the opening of the five ports, Canton, Amoy, Shanghai, Foochowfoo, and Ningpo. He was successively governor and commander-in-chief of Hong-Kong (1843), governor of the Cape of Good Hope (1846), governor and commander-in-chief of Madras (1850-54). His administration of Madras showed that his powers were declining, and he died at Malta on March 18, 1856.

POTTSTOWN, a town of the United States, in Montgomery county, Pennsylvania, on the Schuylkill, between Philadelphia and Reading, 40 miles W.N.W. of the former. It has extensive iron and bridge works, cigar-factories, &c., and stands on the Schuylkill Canal. Pop. (1890), 13,285.

POULTON-LE-FYLDE, a town of England, in

Lancashire, near the western shore of the estuary of the Wyre (which enters the sea at Fleetwood), some 3 miles north-east of Blackpool. It has a church in the Norman style with some interesting features, and chapels for Wesleyans, Congregationalists, and Roman Catholics. In the market-place is an old market cross with stocks and a whipping-post. Pop. (1891), 1412; (1901), 2223.

POUNDAL, the British absolute unit of force, is defined to be that force which in one second will produce in a mass of one pound a velocity of one foot per second. A force of one pound is equal to *g* poundals, where *g* denotes, in feet per second per second, the acceleration due to gravity at the place in question.

POUSHKIN. See **PUSHKIN**.

POUTER, a variety of fancy pigeon, the chief character of which is its very projecting breast. See **PIGEON**.

POVOA DE VARZIM, a seaport and bathing-place of Portugal, in Entre-Douro-e-Minho province, about 16 miles north-west of Oporto. It has an active fishery. Pop. 11,000.

POWAN (*Coregonus clupeoides*), a fish inhabiting Loch Lomond, in Scotland, and also known as the fresh-water herring. It is of the same genus as the pollan and vendace (which see), and is represented by several species in the North American lakes.

POWELL, ROBERT STEPHENSON SMYTH BADEN-English general, son of the Rev. Baden Powell, one of the writers in *Essays and Reviews*, by a daughter of Admiral W. H. Smyth, was born in London on Feb. 22, 1857. He was educated at the Charterhouse, and in 1876 he joined the 13th Hussars as sub-lieutenant. He served with this regiment under Sir Frederick (now Earl) Roberts in India and Afghanistan, and by 1879 he attained the rank of lieutenant, by 1885 that of captain. In 1887 he went to South Africa as assistant military secretary to his uncle, Sir Henry A. Smyth, under whom he took a distinguished part in the Zululand operations of 1888, being specially mentioned in despatches. He followed his uncle to Malta in 1890 in the same capacity, and when his period of service there expired in 1893 he had been promoted major. He was chosen to command the native levies in the Ashanti expedition of 1895, and for his services in that difficult situation was brevetted lieutenant-colonel. In 1896-97 he served as chief of the staff to Sir Frederick Carrington in the Matabeleland campaign, and was again mentioned in despatches, receiving also the brevet rank of colonel. He was in command of the 5th Dragoon Guards during 1897-99, and in the latter year was sent to South Africa to organize a force of irregular horse in Rhodesia and Bechuanaland. Just before the outbreak of the South African War in October, 1899, he was sent to take charge of the small town of Mafeking on the western frontier of the Transvaal. The town was completely invested by the Boers under Cronje on October 15, and nine days later heavy guns were brought from Pretoria and placed in position. For more than seven months the small garrison and civilian population had to endure all the hardships of a siege, accompanied by constant bombardment. Several sorties were made from the town, notably on December 26, when the severe fight on Game Tree Hill was fought. On January 25, 1900, Lord Roberts sent a message promising relief, and on April 20 another message from the commander-in-chief reached the inhabitants, asking them to hold out till May 18. Early in the morning of May 17 the town was relieved by the united forces of Colonels Mahon and Plumer, the former of whom had advanced north from Vryburg, while

the latter, marching southwards, had joined him at Jan Massibi's, about 18 miles west of Mafeking. The news of the relief was received with the wildest rejoicing not only in Great Britain but also in the colonies, and Colonel Baden-Powell was promoted to the rank of major-general and created a Companion of the Bath. After organizing a South African Constabulary and conducting operations in the Transvaal, he returned to England in 1901. General Baden-Powell is the author of books on *Pig-Sticking* (1889); *Reconnaissance and Scouting* (1890); *Cavalry Instruction* (1895); *The Downfall of Prempeh* (1896); *The Matabele Campaign* (1896); and *Aids to Scouting* (1899).

POWER OF ATTORNEY. See **ATTORNEY.**

POYNTER, SIR EDWARD JOHN, a distinguished English painter, son of an architect, was born at Paris on March 20, 1836. He received his general education in Westminster school and Ipswich grammar school, studied art in English schools in 1854-56, and completed his artistic training in Paris under Gleyre in 1856-59. His picture of Israel in Egypt was the chief work in the Royal Academy exhibition of 1867, and the reputation gained by it was maintained by *The Catapult*, exhibited in the following year. In 1869 he was elected an associate of the Academy, and in 1876 he was advanced to full membership. In the interval he held the Slade professorship of Fine Art in University College, London (1871-75), and among his oil pictures of this period are: *Perseus and Andromeda* (1872), 'a noble painting'; *The Fight between More of More Hall and the Dragon of Wantley* (1873); *Rhodope* (1874), 'of high quality and great merit'; *The Golden Age* (1875); *The Festival* (1875); and *Atlanta's Race* (1876), a masterpiece. His diploma picture was *The Fortune-Teller* (1877), which was exhibited in the same year as his portrait of Mrs. Archibald Milman. His chief subsequent works are the following: *Zenobia Captive* (1878); *Portrait of Mrs. Langtry* (1878); *Nausicaa and her Maidens playing at Ball* (1879); *Alfred Baldwin, Esq.* (1879), a capital portrait; *Helen of Troy* (1881), a superb picture; *The Earl of Wharfedale* (1881), an admirable portrait of a patron for whom he has done some fine decorative work; In the *Tepidarium* (1882); designs for the ornamentation of the interior of the dome of St. Paul's Cathedral with subjects from the *Apocalypse* (1882); *The Ides of March* (1883), a most impressive work; *Psyche* (1883); *Portrait of Bishop Barry of Sydney* (1884); *Diadumene* (1885); a *Portrait of himself for the Uffizzi Gallery* (1888); *Portraits of the Earl of Harewood and Miss Burne-Jones* (1888); *Under the Sea-Wall* (1888); *A Roman Boat-Race* (1889); *Music, Heavenly Maid* (1889); *On the Terrace* (1889); *A Corner of the Villa* (1889); *On the Temple Steps* (1890); *Pea Blossom* (1890); *The Meeting of Solomon and the Queen of Sheba* (1890), one of his best works; *When the World was Young* (1892); *Chloe* (1893); *Idle Fears* (1894); *Horæ Serenæ* (1894); designs for the new coinage (1894); *The Ionian Dance* (1895); *An Oread* (1896); *Neobule* (1896); *Phyllis* (1897); *The Message* (1897); *Portrait of Sidney Colvin* (1897); *Portrait of the Duchess of Somerset as Jane Seymour* (1898), a 'superb piece of portraiture'; *Duart Castle* (1898); and *The Skirt Dance* (1898). He has also painted in water colour. For a time he was director and principal of the National Art Training School at South Kensington, and since 1894 he has been director of the National Gallery. On the death of Sir John Millais in 1896 he was elected his successor in the presidential chair of the Academy, and in that year also he received the honour of knighthood. His

only important publication is *Ten Lectures on Art* (1879). Most of Sir Edward Poynter's subjects are taken from classical antiquity and mythology, especially the former, and his treatment shows effectiveness in general conception and careful drawing. Until about 1889 his flesh-painting was defective, but since then it leaves little to be desired.

POZAREVATZ. See **PASSAROWITZ.**

PRAHRAN, a town in the state of Victoria, Australia, about 3½ miles south-east of Melbourne, of which it is a suburb. It is, however, a separate municipality, and in 1879 it was made a city. Many of the streets are lined with elms, silver poplars, and other trees; and there are many fine buildings, including the town-hall, a large free public library, state schools, &c. Good roads connect it with Melbourne and other places in the colony. Pop. 41,161. See **MELBOURNE.**

PRAIA, or LA PRAIA, capital of the Cape Verde Islands, on the south-east coast of San Thiago. It is unhealthy. Before 1770 Ribeira Grande was the capital. Pop. (of Praia) about 4600.

PRAIRIE-HEN, the popular name of the pinnated grouse of the United States (*Tetrao cupido*). The neck of the male is furnished with neck-tufts of eighteen feathers, and is remarkable also for two loose, pendulous, wrinkled skins, which somewhat resemble an orange on inflation. The prairie-hen is much prized for the table. See **GROUSE.**

PRAIRIE-SQUIRREL, or GOPHER, a name for several animals of North America, of the genus *Spermophilus*, found in the prairies in great numbers. They live in burrows and not on trees, and much resemble the prairie-dog or marmot. They have cheek-pouches, in which their food is carried. This consists of prairie plants with their roots and seeds.

PRAIRIE-WOLF, or COYOTE (*Canis latrans*), the small wolf which is found on the prairies in North America, believed by many to be a mere variety of the European wolf. It is a cowardly animal, and only dangerous to man when in packs and pressed by hunger. See **WOLF.**

PRESBYOPIA, or PRESBYOPIA, that is, 'old-sightedness', an affection of the eye common at an advanced stage of life. Its effect is to render objects near the eye less distinct than those at a distance. Persons affected with presbyopia generally have to use convex spectacles. See **SIGHT, DEFECTS OF.**

PRESBYTER. See **PRESBYTERIANS, BISHOP, &c.**

PRESBYTERY, a judicatory, consisting of the pastors of all the churches of any particular Presbyterian denomination within a given district, along with one elder from each church-session commissioned to represent the congregation in conjunction with the minister. The functions of the presbytery are, to grant licences to preach the gospel, and to judge of the qualifications of such as apply for them; to ordain ministers to vacant charges; to judge in cases of reference for advice, and in complaints and appeals which come from the church-sessions within the bounds of the presbytery; and generally to superintend whatever relates to the spiritual interests of the several congregations under its charge, both in respect of doctrine and discipline. Appeals may be taken from the presbytery to the provincial synod, and thence to the general assembly. See **PRESBYTERIANS.**

PRESIDENT, signifying he who presides, has several special and technical senses. It is used for: (1) the principal member of a society or association, who takes the chair when present at meetings; (2) the chief official of a company or board; (3) the head of a university or college, or of a learned

faculty; (4) the elected chief of a republic. In England, the Lord-president of the council, the chief of the privy-council, is an officer of state whose duty is to act as a sort of intermediary between the sovereign and the council. In Scotland, the Lord-president of the Court of Session is the presiding judge in the supreme court.

PRESSENSÉ, EDMOND DEHAULT DE, French theologian, born in Paris on June 3, 1824, studied theology under Vinet at Lausanne (1842-45), Tholuck at Halle (1846), and Neander at Berlin (1847). In the last-mentioned year he was appointed pastor of the independent church of Taitbout in Paris. Throughout his whole career he was an eloquent opponent of the connection of church and state, and an able supporter of orthodox Christianity. He also took part in politics, and under the empire was a leading member of the Liberal Union. In 1871 he was elected to the National Assembly by the department of the Seine, and thenceforward he constantly sought to consolidate the republic on a thoroughly liberal basis. He was elected a life senator in 1883, and in 1890 he became a member of the Academy of Moral and Political Sciences. He died in Paris on April 8, 1891. He founded the *Revue Chrétienne* in 1854 and conducted it till his death. His published works include:—*Conférences sur le Christianisme dans son Application aux Questions Sociales* (1849); *Histoire des Trois Premiers Siècles de L'Église Chrétienne* (six vols., 1856-77; 2nd ed., begun 1887), translated into English (four vols., 1888); *L'Église et la Révolution Française* (1864; 3rd ed., 1889; English translation, 1869); *Jésus-Christ, son Temps, sa Vie, son Œuvre* (1866; 7th ed., 1884; English translation), a reply to Renan's *Vie de Jésus*; *Le Concile du Vatican, son Histoire et ses Conséquences Politiques et Religieuses* (1872); *La Liberté Religieuse en Europe depuis 1870* (1874); *Le Devoir* (1875); *Études Contemporaines* (1880), translated into English as *Contemporary Portraits*; *Les Origines* (1883; 2nd ed., 1887), translated as *The Study of Origins*; *Variétés Morales et Politiques* (1885); and *Alexandre Vinet* (1890); besides *Études Évangéliques* and other devotional writings. He received honorary degrees from Breslau and Edinburgh. His wife and a son are also known as authors. See biographies by Loyson (1891) and Roussel (1894).

PRESTEIGNE, a market town of Wales, in Radnorshire, 7 miles east-north-east of New Radnor, formerly a parliamentary borough (Radnor district). It is a picturesque little town in a fine valley, with many houses of quaint appearance, and contains a church in the Perpendicular style (restored), and several other places of worship; shire hall, market hall, grammar school, &c. Brewing and malting are carried on. Pop. (1891), 1360; (1901), 1237.

PRESTWICH, a town of England, in Lancashire, 4 miles north-west of Manchester, a favourite residence of Manchester merchants. It gives name to a parliamentary division of the county and to a parish, the latter containing Oldham. There are some manufactures, mostly related to those of Manchester. Pop. (1891), 10,902; (1901), 12,839.

PREVENTION OF CRIMES ACT (1871) provides, amongst other things, for the keeping of a register of criminals, with photographs of those convicted of crime, for bringing under police supervision persons twice convicted, for protecting police constables in the execution of their duty, for removing to industrial schools the young children of female criminals, for preventing the resetting of stolen property, and for the granting of search-warrants for buildings where stolen property is suspected to be hidden.

PREVENTION OF CRUELTY TO ANIMALS. See **ANIMALS** (CRUELTY TO).

PRIBRAM, a town of Central Bohemia, 48 miles to the south-west of Prague, in a district where are rich lead and silver mines. Pop. (1890), 13,142.

PRIBYLOV (or **PRIBYLOFF**) ISLANDS, a group of small islands on the coast of Alaska, in Behring Sea, belonging to the United States. The largest are St. Paul, St. George, Walrus, and Beaver Islands. They are frequented by numbers of fur-seals. The natives are Aleutians. See **ALASKA**.

PRICKLES, in botany, are outgrowths of the epidermis of plants, as, for example, in the Rose and the Bramble. They are to be distinguished from the various forms of *spines* or *thorns* (which see in **SUPP.**). Prickles are of little or no morphological significance.

PRICKLY ASH, a name given to several prickly shrubs of the United States, belonging to the genus *Xanthoxylum*, of the order Rutaceæ, and especially to the species *X. fraxineum*. They have an aromatic and pungent bark, which, from being used as a remedy for toothache, gains them the name of *toothache-tree*.

PRICKLY HEAT, the popular name of an eruptive skin disease occurring in hot weather or in hot climates. One variety of it is a kind of lichen. Tar ointments are used to relieve and cure this and similar affections. See **LICHEN** in **SUPP.**

PRIMARY, in geology, a term applied by the early geologists to rocks of a more or less crystalline structure, supposed to owe their present state to igneous agency. They were divided into two groups: *stratified*, consisting of gneiss, mica schist, argillaceous schist, hornblende schist, and all slaty and crystalline strata generally; and *unstratified*, these being chiefly granite. By geologists of the present day the term primary is used as equivalent to *palæozoic*. See **GEOLOGY**.

PRIMROSE LEAGUE, a political organization founded in 1883 by members of the so-called Fourth Party (consisting of Lord Randolph Churchill and a few others) in memory of the Earl of Beaconsfield. The name was chosen in accordance with a mistaken notion that the primrose was Lord Beaconsfield's favourite flower. The league is now one of the strongest bulwarks of the Unionist party, and during the general election of 1895 it exerted no small influence. The members include knights, dames, and associates, and are divided into groups called habitations. In their propaganda they rely less on discussion, lectures, &c., than on the appeal to the social elements in human nature; and the rapid increase of membership is due mainly to the efforts of female members. In 1900 the league had 1,710,040 members on its roll, the number of habitations being 2401.

PRINCE'S FEATHER, *Amaranthus hypochondriacus*, an annual plant of the order Amaranthaceæ, with erect spikes of dark-red flowers and leaves inclining to purple. It is a native of Virginia, but has long been cultivated in this country.

PRINCE'S ISLAND, or **ILHA DO PRINCEPE**, a Portuguese island off the coast of the German Cameroons region, West Africa, lying nearly midway between Fernando Po and St. Thomas Islands. It is of volcanic character, rising in the south to 3000 feet; fertile and well-watered, but of little importance since the extinction of the slave-trade ruined its sugar-plantations. Its fertility has gained it the name of the Garden of Africa. Cacao is the only important export. The population consists nearly exclusively of Creoles and negroes, and is concentrated mainly in São Antonio, a town with a fine harbour on the north-east coast. With the

neighbouring island of S. Thomé it constitutes a province under a governor.

PRINCE'S PINE. See **PIPSISSEWA** in SUPP.

PRINCEPE. See **PRINCE'S ISLAND** above.

PRIVILEGED COMMUNICATION. See **CONFIDENTIAL COMMUNICATION.**

PROBATE DUTY, a tax upon the gross value of the personal property of a deceased person levied by means of a stamp upon the affidavit required of a person applying for probate (which see). Previous to 1894 probate duty used to be charged separately on the estates of deceased persons, but since that date it is not exacted as such, the new estate duty then fixed covering all death duties.

PROCESS, in law, a term applied in its widest sense to the whole course of proceedings in a cause real or personal, civil or criminal. In strictness, the term denotes the summons by which one is cited before a court, or the commencement of a legal action.

PROCTER, ADELAIDE ANN, poetess, daughter of the much more famous Barry Cornwall (Bryan Waller Procter), was born in London on Oct. 30, 1825, and died on Feb. 3, 1864. She inherited poetic tastes and abilities and published verses at the age of eighteen, a number of her early poems appearing in Household Words and All the Year Round. She published a volume of poems in 1858 entitled *Legends and Lyrics*, which had a good reception, reached a tenth edition in 1866, and continues to be read. Amongst them were *The Angel's Story*, *A Legend of Bregenz*, and other narrative poems; *The Message*, *The Lost Chord*, and other lyrics. Her *Lost Chord* is well-known through having been set to music by Sir Arthur Sullivan, and various hymns by her are well known. In 1851 she became a convert to the Roman Catholic Church. Her health was never robust, and the cause of her death was consumption. The 1866 edition of her *Legends and Lyrics* contains a biographical notice by Dickens.

PROCTOR, RICHARD ANTHONY, English astronomer, was born at Chelsea on Mar. 23, 1837, being the son of a solicitor. He was educated at King's College, London, and St. John's College, Cambridge, where he distinguished himself in mathematics, but not so greatly as was expected. For a time he read for the bar, and then devoted himself specially to the study of astronomy, on which subject he published a number of valuable works, including *Saturn and its System* (1865); *Handbook of the Stars* (1866); *Half Hours with the Telescope* (1868); *Half Hours with the Stars*; *Other Worlds than Ours* (a very popular work—1870); *Light Science for Leisure Hours* (1871); *The Moon* (1873); *The Transits of Venus* (1874); *The Cycloid and Cycloid Curves*; several *Star Atlases*; *The Universe of Stars* (1878); *Old and New Astronomy* (completed after his death by A. C. Ranyard—1892); &c., besides two treatises on whist. He was very popular as a lecturer, and his work mainly consisted in popularizing astronomical science; but he made several important contributions to our knowledge of the motion of Mars, the proper motion of stars, and other astronomical problems. In 1881 he started a weekly scientific paper on popular lines called *Knowledge*, which four years later was transformed into a monthly. He latterly resided a good deal in the United States, and he died there on Sept. 12th, 1888.

PROCYON, the racoon genus of animals. See **RACCOON.**

PROFIT-SHARING, the name given to that system of conducting private businesses under which the employees, without having any voice in the

regulation of the business, receive, in addition to their wages, a fixed proportion of the profits. This system has been adopted by a good many firms, chiefly on the Continent, and it is claimed that it removes many of the sources of waste at present existing and at the same time gives the workmen a more immediate personal interest in their work. See **CO-OPERATIVE SOCIETIES.**

PROGNATHIC, or **PROGNATHOUS,** in ethnology, a term applied to the skull of certain races of men in whom the jaw slants forwards by reason of the oblique insertion of the teeth. It is determined by the size of the facial or cranio-facial angle. See **FACE.**

PROME, a town of Lower Burmah, capital of a district of the same name, is situated on the Irrawaddy, about 160 miles from Rangoon by rail. It is a large town surrounded by a wall, with extensive suburbs, and, owing to the flat ground on which it is built, it is liable to be inundated by the river. It has silk-weaving and other industries, and exports silk, rice, cotton, &c. Pop. (1891), 30,022.—The district has an area of 2880 square miles, and a population of 322,340.

PROMEROPS, a genus of insectivorous birds, many of which are remarkable for the beauty of their plumage. They have a longish bill, an extensible tongue, and feed upon insects, soft fruits, and the saccharine juices of plants. One species, *P. superba*, is a native of New Guinea; another, *P. erythrorhynchus*, is a native of Africa. They form the type of a family Promeropidae, also called Nectariniadæ.

PROMPTER, one placed behind the scenes in a theatre, whose business is to assist the actors when at a loss, by uttering the first words of a sentence or words forgotten. The prompter is usually placed at one side of the stage, the prompt side, the other side being known as the O.P. or opposite-prompt side.

PRONGBUCK, or **PRONG-HORN ANTELOPE** (*Antilocapra Americana* or *furcifera*), a genus of antelopes, which, with the exception of the Rocky Mountain Sheep (*Haploceros montanus*), constitutes the only genus of antelopes found on the American continent. The prongbuck differs in many important respects from the ordinary antelope, and appears to unite these latter forms in some degree with the goats and sheep genera. This animal, sometimes also known as the cabrit, is peculiar as possessing furcate or forked horns, these structures being possessed by the males only. The horns are of an oval form at the base, and rise upwards for some distance, curving inwards and backwards at their tips, so as to form a well-defined hook. Unlike any other antelope the sheaths of the prongbuck's horns are shed annually—the horns themselves being permanent, as in all the other Antilopidæ. The deer, with which the antelopes are frequently confounded, on the contrary, shed their horns annually. The horns of the prongbuck also possess a snag, branch, or prong on their front surface, and before the commencement of the curve. No accessory hoofs are developed in this animal, and the *lacrimal sinuses* or 'tear-pits' (sacs placed beneath the eyes) found in other antelopes are absent in the prongbuck. This animal inhabits the central North American prairies, its northernmost boundary being about 53° of north latitude. It is said to be especially plentiful in the district between the Saskatchewan and Missouri rivers, and between the Rocky Mountains and the Pacific shores of the continent. But one distinct species is known.

PROPELLER. See **SCREW-PROPELLER.**

PROPORTIONAL REPRESENTATION, in politics, a system of representation by which political parties are represented according to their numbers,

and not in such a manner as that the majority elects all the representatives. Two plans in particular for securing proportional representation have been tried, the one being by providing that voters shall only vote for a proportion of the representatives, say two out of three, or half when the number is even; the other being to give each elector a vote for every one of the representatives and let them give their votes as they please. In 1900 Belgium adopted a system of proportional representation, and a similar method of election is in operation in some Swiss cantons.

PROSIMIÆ, a name applied to the lemurs and their allies. See **LEMUR**.

PROSOBRANCHIATA, an order of gastropods comprising the whelks, periwinkles, &c., mostly marine, though some inhabit fresh water. In this order the respiration is aquatic, the gills are situated in front of the heart, and the auricle in front of the ventricle. It comprises two sections, *Siphonostomata* and *Holostomata*, distinguished by the character of the shell-opening. See **GASTROPODS**.

PROSOPIS, a genus of tropical leguminous trees of the sub-order Mimoseæ, having their pods filled between the seeds with a pulpy or mealy substance. The leaves are bipinnate and usually glaucous. Some of them yield useful products, as resin or tannin, food for cattle, &c. *P. dulcis* and *P. spici-gera* have sweet, succulent fruits, which are known as *algarobilla*. See also **MESQUITE**.

PROSPER OF AQUITAINE, a Christian writer who lived during the early part of the fifth century, but of whom little is personally known. A large part of his life seems to have been spent at Marseilles, where he was connected with an ascetic order. It was here that he wrote his polemical poem *Adversus Ingratos* (attacking the Pelagians), and it is supposed that he finished his *Chronicon Consulare* (an epitome and continuation of Jerome's chronicle) at Rome about 455. Other works by him also exist. He was an admirer and correspondent of St. Augustine, and his writings are partly polemics against the heresies of the Pelagians. His *Chronicle* is of some value, especially for the period near his own time, and it was highly esteemed in the middle ages. There is an edition by Mommsen in the *Monumenta Germaniæ Historica*.

PROSTATE GLAND, a colourless glandular mass, situated in the pelvic cavity, and which surrounds the neck of the bladder and urethra in males. It is liable to enlargement, especially in old age, and is often the seat of various diseases.

PROTEACEÆ, a natural order of arborescent apetalous dicotyledons, comprising about 1000 species, chiefly natives of Australia and the Cape Colony. They are shrubs or small trees, with hard, dry, opposite or alternate leaves, and often large heads of showy and richly-coloured flowers, which render them favourite objects of cultivation. The typical genus *Protea* is African and contains numerous species. *Banksia* is a well-known Australian species bearing the popular colonial name of honey-suckle. There are in all nearly fifty genera, including, besides the two already mentioned, *Dryandra*, *Hakea*, *Grevillea*, and *Persoonia*. See **BANKSIA** in **SUPP.**

PROTEIN, a hypothetical principle of food, obtained from animal or vegetable albumin, fibrin, or casein, which are all considered to be modifications of it. Its existence as a distinct proximate principle is doubtful, and the word is now employed chiefly in compounds, as *protein-bodies* (for which see **PROTEIDS**).

PROTELES. See **AARDWOLF**.

PROTHONOTARY, a term for certain function-

aries connected with the papal court who receive the last wills of cardinals, make informations and proceedings necessary for the canonization of saints, &c.

PROTOCOCCLUS, a genus of algae. *P.* (or *Pal-mella*) *nivalis* (red-snow) appears on the surface of snow, tinging extensive tracts in the Arctic regions or amongst the Alps, in an incredibly short space of time, with a deep crimson. This plant, which may be regarded as one of the simplest forms of vegetation, consists of a little bag or membrane forming a cell. A large number of these are commonly found together, but each one is separate from the rest, and is to be regarded as a distinct individual. Other species are *P. viridis*, found as a green incrustation on tree-trunks, palings, &c., *P.* (or *Hematococcus*) *pluvialis*, found in the water of water-barrels, &c., and *P. atlanticus*, which sometimes makes certain parts of the sea of a scarlet colour.

PROTOGENE, a species of granite composed of felspar, quartz, mica, and talc or chlorite; so called because it was supposed to have been the first-formed granite. It occurs abundantly in the Alps of Savoy, and is found in Cornwall, where, on decomposition, it yields china-clay or porcelain-earth. It is also called *Talcose-granite*.

PROTOPHYTES, a name given to the lowest organisms in the vegetable kingdom, consisting either of a single cell, or of several cells united by a gelatinous substance but without any essential mutual dependence, and corresponding to the Protozoa of the animal kingdom.

PROUT, **EBENEZER**, writer on musical theory and composer, was born at Oundle, Northamptonshire, on March 1, 1835, and educated at Denmark Hill School and University College, London, where he graduated B.A. From 1860 till 1884 he was a professor at the Crystal Palace School, and in 1876-82 at the National Training School for Music. He is a professor in the Royal Academy of Music and the Guildhall School of Music, and he has been musical critic to the Academy and the Athenæum. Since 1894 he has occupied the chair of music in Dublin University. His compositions include several cantatas, concertos, quartets, symphonies, &c., amongst the former being *Hereward* (1878); *Alfred* (1881); *Red Cross Knight* (1886); and *Damon and Phintias* (1888). Of his theoretical works the following may be mentioned: *Instrumentation* (Musical Primers, 1876); *Harmony* (1889); *Counterpoint* (1890); *Double Counterpoint and Canon* (1891); *Fugue* (1892); *Musical Form* (1893); *Applied Forms* (1895); and *The Orchestra* (2 vols., 1898-99).

PROUT, FATHER. See **MAHONY (FRANCIS)** in **SUPP.**

PRUDHON, PIERRE, a French painter, was born at Cluny (Saône-et-Loire) on April 4, 1758, and died in Paris on Feb. 16, 1823. He was the son of a stone-mason, who died very soon after his birth, and he owed his earlier education to the monks of Cluny Abbey. He studied his art at Dijon and in Rome, where he came under the influence of Correggio and of Leonardo. He latterly settled in Paris, where he gradually made his way, and at length became famous by his *Truth descending from Heaven* (1800); *Crime pursued by Justice and Divine Vengeance* (1808); *Psyche carried off by Zephyr* (1812); &c. He was very much hampered by an imprudent early marriage, and in 1803 he contracted a *liaison* with one Constance Mayer, who eighteen years later committed suicide. His importance consists in the fact that, in opposition to David, he accentuated the purely pictorial ele-

ment and the effect of light in his works. Most of his pictures are in French galleries, but there is one (Cupid Chastised) in the National Gallery at Dublin.

PRUNELLA, a kind of woollen stuff of which clergymen's gowns were once made, and which is still used for the uppers of ladies' boots and shoes.

—**PRUNELLA** (or *Brunella*) is also the name of a genus of Labiatae, comprising the common Self-heal (*B. vulgaris*) and some of our cultivated plants. The former is common in moist pastures, and has dense heads or spikes of purple two-lipped flowers.

PRUNUS, a genus of arborescent plants belonging to the natural order Rosaceae, and comprehending the cherry, bird-cherry, plum, damson, sloe, bullace, &c. See articles on the plants named.

PRURITUS, the technical name for a troublesome degree of itching. See **ITCH**.

PRUSSIAN BROWN, a colour obtained by adding a solution of the yellow prussiate of potash to a solution of sulphate of copper, which throws down a precipitate of deep brown. This, when washed and dried, is equal to madder, and possesses greater permanency.

PSEUDOPODIA, in zoology, the organs of locomotion characteristic of the lower Protozoa. These consist of variously-shaped filaments, threads, or finger-like processes of sarcode, which the animal can thrust out from any or every part of its body. See **PROTOZOA**.

PSIDIUM. See **GUAVA**.

PSITTACIDÆ, the parrot tribe, a family of scansorial birds, comprising over 300 species, of which the genus *Psittacus* is the type. See **PARROT**.

PSOAS, an important muscle of the human body which extends from the lumbar region to the thigh-bone, and along with the iliacus assists in the movements of the thigh, especially in bending the hip-joint. See Plate II. at **ANATOMY**.

PSYCHICAL RESEARCH, SOCIETY FOR, an English society, founded in 1882, 'for the purpose of making an organized attempt to investigate that large group of debatable phenomena designated by such terms as mesmeric, psychical, and spiritualistic'. This society has made investigations into so-called obscure phenomena of various kinds, including spiritualism, clairvoyance, hallucination, apparitions, &c., and has given much attention to *telepathy* (or the power of one mind to influence another mind at a distance and without the usual organs of sense), the results of which have been published in Reports and Proceedings, as well as in a book called *Phantasms of the Living* (two vols., 1886).

PTERIS, the genus of ferns to which the bracken belongs, and which is widely spread throughout the world. See **BRACKEN**.

PTEROCARPUS, a genus of leguminous plants, species of which yield kino, dragon's-blood, red sandal-wood, &c.

PTERYGOTUS, a gigantic fossil crustacean occurring chiefly in the passage-beds between the Silurian and Devonian systems. It has a long lobster-like form, composed in the main of a cephalothorax, an abdominal portion of several segments, and a somewhat oval telson or tail-plate.

PTOMAINE (from Gr. *ptōma*, a dead body), one of a class of alkaloids or organic bases, which are generated in animal substances during putrefaction, during morbid conditions of the body prior to death, and even, it is said, during normal healthy conditions of life. Some of them are highly poisonous, and in their action may even resemble strychnine. There have been a number of cases of poisoning through the eating of sausages, and also manifest

symptoms of irritant poisoning after the eating of tinned (or canned) meats. Such cases appear to be due to the presence in the meat of such ptomaines that have been developed as the result of decomposition of some of the albuminous constituents of the meat. But the subject as yet remains in some obscurity.

PTOSIS, a drooping of the eyelid owing to paralysis of the muscle that lifts it. It is sometimes congenital, and it may be produced by various disorders of the brain.

PTYALIN, a ferment forming the chief constituent of saliva. It aids in the digestion of food by converting starchy materials into soluble sugars.

PTYALISM, or **SALIVATION**, a disease characterized by a constant dribbling from the mouth of badly-smelling saliva. It is accompanied by inflammation of the tongue, gums, and salivary glands, and is frequently due to the use of mercury. In addition to mouth-washes, such as potassium chlorate, various aperients and iodide of potassium should be taken.

PUBLIC PROSECUTOR, an official charged with the prosecution of all criminal offences. See **PROSECUTIONS**.

PUBLIC SCHOOLS, the schools, especially the elementary schools, established under any national system of education; but in England the term is often specifically applied to certain important secondary schools or colleges, including Eton, Harrow, Winchester, Rugby, Westminster, St. Paul's, Shrewsbury, &c., known as 'the great public schools of England'.

PUBLIC WORKS LOAN COMMISSION, a body in England authorized to lend the money of the state for useful local purposes. Unless where special acts of parliament, such as the public health and education acts, leave them no option, the commissioners judge for themselves of the sufficiency of the security offered by the applicants for loans, and whether the objects for which they are asked are of adequate utility to justify loans of public money.

PUCCOON. Same as Blood-root, which see in **SUPP.**

PUDDING-BERRIES, the berries of the Canadian dogwood (*Cornus canadensis*), common throughout North America. See **DOGWOOD**.

PUEBLO, a rapidly-increasing city of the United States, capital of Pueblo county, Colorado, on both sides of the Arkansas River, at the confluence of the Fontaine qui Bouille, 120 miles south of Denver, forming a meeting point of numerous railways, in a rich agricultural district with abundant supplies of coal and iron adjacent. It has a number of fine buildings, including an opera-house, one of the finest in the West, the Colorado Mineral Palace, a Methodist college, a state asylum for the insane, &c., and has water-works, electric lighting, and electric cars. There are blast-furnaces, steel-works, rolling-mills, and many other industrial establishments. Pop. (1880), 3217; (1890), 24,558; now over 30,000.

PUEBLO INDIANS are semi-civilized Indians of the Western United States, in New Mexico and Arizona, some 9000 in number, living in villages in communal houses (a number of families together), and possessed of considerable skill in agriculture and the simpler kinds of manufacture. Their village communities are self-governed, and they are only nominally citizens of the United States. The chief tribes now existing are the Zunis, Toltos, Tiguas, Queres, and Jemez, and their largest pueblo is Zuni, with a population of 1621. Taos is next in importance.

PUENTE-JENIL, a town of Spain, in the pro-

vince of Cordova, on the Jenil, some 32 miles from Cordova. It is a station on the railway from Malaga to Cordova, and is situated in an olive-growing district. Pop. (1887), 11,407.

PUERPERAL MANIA is a form of insanity developed during pregnancy or after childbirth, and is invariably the effect of exhaustion or debility.

PUERTO-BELLO. See **PORTO-BELLO**.

PUERTO CORTEZ (or **CABALLOS**), a seaport of Honduras, in the north-western corner of the republic, on the east of Honduras Bay. It has a good anchorage, and is being connected by rail with the Gulf of Fonseca on the Pacific. Pop. about 2000.

PUERTO-MONTT, a seaport of Southern Chili, capital of the province Llanquihue. It is about 600 miles southwards from Valparaiso, at the head of Reloncavi Gulf, a little south of Lake Llanquihue. It is a town of comparatively recent foundation, and has now a fair trade. Pop. 4000.

PUERTO PLATA, the chief port of Santo Domingo (Haiti), on the north coast of the island and north by west from San Domingo, the capital. Pop. 4500.

PUFF-BALLS, so called from their globular shape, and because if they are struck when ripe the dry spores fly out in powder like a puff of smoke, form the genus of fungi *Lycoperdon*, belonging to the Gasteromycetes. When young, and whether raw or cooked, some of them are very good eating. In Britain they are represented chiefly by the species *L. gemmatum* and *L. giganteum*, the latter of which sometimes attains an enormous size. An allied genus *Bovista* is also represented by a few British species. The fumes from puff-balls have been used as an anæsthetic.

PUGAREE, **PUGGERIE**, the name in India for a piece of muslin cloth wound round a hat or helmet to protect the head by warding off the rays of the sun.

PUG-MILL, a machine for mixing and tempering clay. It consists of a hollow iron cylinder, generally set upright, with a revolving shaft in the line of its axis, carrying a number of knives projecting from it at right angles, and arranged in a spiral manner. The clay is thrown in at the top of the cylinder, and by the revolution of the shaft is brought within the action of the knives, by which it is cut and kneaded in its downward progress, and finally forced out through a hole in the bottom of the cylinder.

PUISNE, in law, younger or inferior in rank. The several judges and barons of the divisions of the high court of justice, other than the chiefs, used to be called puisne judges.

PULEX. See **FLEA**.

PULICAT, a town of India, in the Chingleput district of Madras Presidency, situated at the southern extremity of an island dividing the sea from Pulicat Lake, 23 miles north of Madras city, the earliest settlement of the Dutch on the mainland of India (1609). Pop. (1891), 5392. This town gave name to a kind of handkerchiefs called pullicates (which see below).

PULLICATE, a kind of check cotton handkerchief formerly made in Scotland in imitation of similar goods made in India, and so called from the town Pulicat (which see above).

PULLMAN-CAR, a luxuriously-fitted-up railway-carriage, named after its American inventor, for the use of which an extra charge is frequently made, and which is specially adapted for sleeping in, or as a drawing-room or dining car. It is of great length, and is mounted on bogie-wheels so as to take sharp curves.

PULMOBRANCHIATA, an order of gasteropod molluscs (also called by some naturalists *Pulmonata*), in which the respiratory organ is a cavity formed by the adhesion of the mantle by its margin to the neck of the animal. The greater part of them are terrestrial, among these being the snails and slugs. See **PULMONARIA**.

PULO BABI, **HOG ISLAND**, or **SIMALU**, a Dutch island off the northern part of the west coast of Sumatra. It is about 60 miles long, and contains no settlement. The inhabitants are savages, professing Mohammedanism, and but little is known either of them or of their island.

PULO-NIAS, same as **Nias** (which see).

PULTENEY, **WILLIAM**, **EARL OF BATH**, English politician, was born in London on March 22, 1684, of an old Leicestershire family, and died on July 7, 1764. Educated at Westminster School and Christ Church, Oxford, he entered the House of Commons in 1705 as member for a Yorkshire borough, and became a privy-councillor and secretary at war at the accession of George I., being then a friend and partisan of Walpole. After Walpole became first lord of the treasury in 1721, Pulteney considered himself slighted, and showing his resentment in the House of Commons, was dismissed by his old ally from his lucrative sinecure, the cofferership of the household. Pulteney now became the strenuous and eloquent leader of an opposition to Walpole, and co-operated with Bolingbroke in the production of the anti-ministerial Craftsman. When Walpole was at last driven from office in 1742, Pulteney was intrusted with the formation of a new ministry, but the composition of it so disappointed the public hopes that he lost his popularity, especially on his acceptance of a peerage, the Earldom of Bath. In 1746 he became the head of a ministry which lasted only two days. He was little heard of afterwards in public life. He is chiefly remembered, if at all, as an orator. As a politician he failed; and the chief defect of his personal character was a too great love of money.

PULŪ, a silky fibrous substance obtained from ferns of the genus *Cibotium*, and exported from the Sandwich Islands. It is used for stuffing mattresses, &c. Other species growing in the East Indies, Mexico, &c., yield a similar substance.

PULZA-OIL, the oil yielded by the physic-nuts (which see).

PUNAKHA, the winter capital of Bhutan state, India, on the Bhagni river, 100 miles to the south-east of Darjeeling. It has a mild climate, and is a place of great natural strength.

PUNCH, or **The London Charivari**, an illustrated weekly comic paper published in London, the first attempt in English comic journalism which achieved success. It issued its initial number July 17, 1841, under the editorship of Mark Lemon, assisted by Henry Mayhew; and Thackeray, Jerrold, Gilbert & Becket, Hood, &c., were among its earlier contributors. Richard Doyle and John Leech were the chief of its earlier illustrators; the chief artists latterly on its staff including Sir John Tenniel, G. du Maurier, C. Keene, Linley Sambourne, E. T. Reed, &c. After Mark Lemon's death Punch was edited by Shirley Brooks and Tom Taylor successively. Its present editor is Mr. F. C. Burnand. See *Spielmann's History of Punch* (1895).

PUNJNUD, the name given to the stream which pours into the Indus, about 70 miles above the Sind frontier, the combined waters of the five rivers, the Sutlej, the Beas, the Ravi, the Chenab, and the Jhelum. See **PUNJAB** and **INDUS**.

PUNNAH, or **PANNA**, a native state of India, in Bundelcund, by the British agency of which it is

politically superintended, formerly very prosperous from the yield of its diamond mines. Estimated area, 2568 square miles; pop. (1891), 239,333.—PUNNAH is the chief town, and has several fine Hindu temples and other public buildings. Pop. (1891), 14,676.

PUNNIAR, a town in Gwalior state, in Central India, 12 miles to the south-west of Gwalior fort. Here a British detachment defeated and routed a Mahratta force 12,000 strong on the 29th December, 1843.

PUNTA ARENAS, officially VILLA DE PUNTA, a convict station and capital of the Chilian territory of Magallanes, a free port at which most steamers passing through Magellan Strait call, there being coal in its vicinity. Pop. (1895), 3227.

PUNTA RASSA, a small town or village on the west coast of Florida, in the United States, at the mouth of the Caloosahatchee river, about 110 miles south by east of Tampa. Like several other places along the Florida coast, its climate is well suited for consumptives and persons in general ill-health.

PUNTARENAS, the principal port of Costa Rica, Central America, on the Pacific Coast, Gulf of Nicoya. A railway connects it with Esparza, 14 miles inland, and is being continued to Alajuela. The exports mainly consist of coffee, india-rubber, dye-woods, and hides. Pop. 3000.

PUPILARITY. See AGE.

PUPIL-TEACHER, a boy or a girl, not younger than fourteen, engaged by the managers of a public elementary school to teach other pupils, under the superintendence of the principal teacher, during school hours, and out of school hours receiving instruction. Before being engaged the candidate must produce certificates as to character, health, &c., and pass an examination. The normal engagement of a pupil-teacher is for four years, but it may be shortened to three or two, according to age and proficiency. There are periodical examinations of pupil-teachers, and the range of teaching is annually extended. At the end of the engagement the pupil-teacher may become a candidate for admission to a training college, or, if passing a satisfactory examination, may be recognized as an assistant-teacher in a public elementary school. Institutes for the instruction of pupil-teachers have been established by various school boards in recent years, but the maintenance of these out of the school rates has been recently declared illegal in England.

PURANDHAR, a town of India, in Poona district, Bombay, 20 miles south-east of Poona city, once a fortress, and now a sanatorium for European troops.

PURBECK MARBLE, PURBECK STONE, an impure fresh-water limestone obtained from the Purbeck beds. It takes on a good polish, but is deficient in durability under exposure to the air, and has hence lost much of its favour as a building-stone. It is much used for slender shafts in the interior of Gothic buildings, for which purpose it answers well.

PURDY ISLANDS, a group of small German islands situated between New Guinea and the Admiralty Islands. Two of the islands are called Mole and Mouse; and phosphate of lime is found on them in considerable quantity.

PURI. See POOREE in SUPP. and JUGGERNAUTH.

PURIM, a Jewish festival observed on the 14th and 15th of Adar (March), instituted, according to the Jewish view, to commemorate the preservation of the Jews in Persia from the destruction threatened them by the schemes of Haman (Esther ix.).

PURPLE-BLACK, a preparation of madder used as a pigment. See MADDER.

PURPLE-EMPEROR, the *Apatura Iris*, a large, somewhat rare, and richly-coloured British butterfly; so called from the splendid purple iridescent colour of its fore-wings. It may be seen during the first half of July perched on the highest branches of a tall oak or other tree. The caterpillar is green, with pale-yellow lines, and may be found on the sawtooth towards the end of May. The chrysalis is also green.

PURPLE-HERON (*Ardea purpurea*), an occasional visitor to Britain, of which the occipital plumes are glossy black tinged with purple. In habits it resembles the bittern rather than the common heron.

PURPLE-WOOD, the heart-wood of *Copaifera pubiflora* and *C. bracteata*, imported from the Brazils, well adapted for mortar-beds and gun-carriages, and also used for ramrods, buhl-work, marquetry, and turnery. These trees belong to the order Leguminosæ, and have abruptly-pinnate leaves, and spikes of white flowers.

PURPURA, a genus of gasteropod molluscs, of which the greater number are littoral. It comprises nearly one hundred and fifty species, with an almost world-wide distribution. Only one of these is British, namely the Dog Periwinkle (*P. lapillus*). They have striate or tuberculated shells with a short spire and a wide opening slightly notched. Their food consists of limpets, mussels, &c.; and if necessary they will bore through the shells of these molluscs in order to satisfy their hunger. Many of these molluscs, including the British species, secrete a fluid which is of a purplish colour, but one in particular furnished that celebrated and costly dye of antiquity called the Tyrian purple. See PURPLE.

PURQUEIRA OIL, same as Pulza-oil (which see above).

PURSE-CRAB, a name for decapod crustaceans of the genus *Birgus*, belonging to the family Ceno-bitidae and allied to the hermit-crabs. A species, *B. latro* (the robber-crab or palm-crab), found in the Mauritius and the more eastern islands of the Indian Ocean, is one of the largest crustaceans, being sometimes 2 to 3 feet in length. It resides on land, while paying a nightly visit to the sea, often burrowing under the roots of trees, lining its hole with the fibres of the cocoa-nut husk and living on the nuts, which (according to some writers) it climbs the trees to procure, and the shells of which it certainly breaks with great ingenuity. In his Voyage Darwin describes how this or a similar species found in the Keeling Islands penetrates the cocoa-nuts.

PURU, or PURUS, a river of South America, which, rising in the east of Peru, enters Brazil, and, flowing north-east, after a course of over 1800 miles joins the Amazon about 100 miles above the confluence of the Madeira with the latter. At high water it is navigable almost throughout its length. It has a very winding course and a comparatively slight fall. Chief among its numerous tributaries is the Acre.

PURVEYANCE, formerly in England the exercise by officials called *purveyors* of the royal prerogative, involving a right of pre-emption, by which the king was authorized to buy provisions and necessities for the use of his household at an appraised value, in preference to all his subjects, and even without the consent of the owner; it included the right of impressing horses and carriages, &c., for the use of the sovereign. It was also practised by many of the great English nobles. It led to much oppression and many exactions, and a number of statutes were passed to prevent them. That of 1362 removed for a time many of the more flagrant abuses attaching to it, but soon the ingenuity of those interested contrived to make the custom as odious.

and oppressive as ever. We find frequent reference to it under the early Stuart kings, and its abolition was included in the abortive Great Contract of 1610. In 1660 the Convention formally abolished it, and no attempt has since been made to revive the right.

PURVEYORS, ARMY, were officers charged with superintending the civil affairs of army hospitals, such as the payment of men, procuring provisions, medical comforts, bedding, &c. In 1870 the purveyors' department was merged into the then newly-formed control department, which afterwards became that of the commissariat and transport staff, and this has more recently been transformed into the army service corps.

PURWA, a town of India, in Unao district, Oude, 20 miles to the south-east of the town of Unao, with manufactures of shoes and leather-work. Pop. (1891), 9719.

PUSEYISM. See TRACTARIANISM.

PUSHKAR, or **POKHAR**, a town of India, in Ajmere-Merwara, Rajputana, the only one in India containing a temple dedicated to Brahma. A great fair in October and November is attended by about 100,000 pilgrims. Pop. 5000.

PUSTULE, a small and nearly rounded elevation of the cuticle, with an inflamed base, and containing pus. Diseases known as 'pustular diseases' are those that are characterized by true pustules. Small-pox and chicken-pox are accompanied by pustules, but these are regarded as febrile, not pustular diseases, the eruption being not primary but secondary.

PUTCHOCK, **PUCHUCK**, the root of *Aplotaxis Lappa*, the *Costus* of the ancients, a composite plant growing on the Himalayas in the vicinity of Cashmere. It has long lyrate leaves and heads of purple florets. It is exported to the Malay countries and to China, where it forms a main ingredient in the Chinese pastille-rods known as *joss-sticks*. In Upper India it is given as a medicine in various complaints ranging from coughs to cholera, and is also employed in several other ways.

PUTTEALA. See PATIALA in SUPP.

PUTTENHAM, GEORGE, an English writer, regarded as the author of a work entitled *The Arte of English Poesie*, contrived into three books; the first of Poets and Poesie, the second of Proportion, the third of Ornament, which appeared anonymously in 1589. If its author, he was, from indications given in that and another work from the same pen, born about 1530, and became a scholar of Oxford. In 1579 he presented his *Partheniades* to Queen Elizabeth, to whom he was a gentleman-usher. The *Arte* is a review of ancient as well as modern poetry, and was written for the court and to instruct in versification. It shows considerable literary knowledge and no small critical power. Its author wrote several other pieces which have been lost. The authorship of *The Arte* has also been claimed for Richard Puttenham, brother of the above.

PUZZLE-MONKEY, a popular name for the Chilean pine, *Araucaria imbricata*. See ARAUCARIA.

PYE, HENRY JAMES, poet laureate, was born in London on July 10, 1745, of an old Berkshire family. Educated at Magdalen College, Oxford, he entered parliament in 1784 as M.P. for Bucks. Having in 1775 published a translation of six odes of Pindar, in 1778 one of Frederick the Great's Art of War, and in 1786 another of the Poetics of Aristotle, with a commentary, he was, in 1790, appointed poet laureate. In 1792 he was appointed a Westminster police magistrate. In 1801 appeared his *Alfred*, an epic. He died near Harrow on Aug. 13, 1813. Pye is only remembered now as the subject of some depreciatory references by Byron.

PYE, JOHN, English engraver, was born in Birmingham on April 22, 1782, and died in London on Feb. 6, 1874. He was mainly self-taught till his twentieth year, when he went to London to study and work under James Heath. He soon gained a high reputation for his engravings of Turner's landscapes, beginning with Pope's Villa in 1811, and including *The Temple of Jupiter at Aegina*; *Hardraw Fell*; *Wycliffe, Yorkshire*; *Ehrenbreitstein*; *Weatheroote Cave*; *Rialto, Venice*; *La Roccia*; *St. Mary Redcliffe, Bristol*; and *Junction of the Greta and the Tees*. His other engravings comprise *The Annunciation* (Claude Lorrain); *The Holy Family* (Michael Angelo); *Evening* (George Barrett); *Classical Landscape* (Gaspard Poussin); *The last of William Smith (Landseer)*; and *Scenes in India* (Daniel). He was an opponent of the Royal Academy and published a work on *The Patronage of British Art*. He passed much of his life in Paris, and was elected a corresponding member of the French Institute. From 1858 he ceased to practise his art. His elder brother Charles is also known as a line-engraver.

PYELITIS, inflammation of the pelvis of the kidney, a very troublesome disease caused by exposure to cold, blood-poisoning, &c. It is very difficult to cure.

PYMMA-WOOD, the wood of the *Lagerstromia reginae*, an Indian tree of the order Lythraceae. See BLOOD-WOOD in SUPP.

PYRETHRUM, a genus of herbaceous plants nearly allied to *Chrysanthemum*, *Matricaria* (wild camomile), and *Anthemis* (camomile). *P. Parthenium* is known as feverfew; from *P. roseum* is made the well-known Persian insect-powder. See FEVERFEW.

PYRGOS, a town of Greece, near the west coast of the Morea, and not far from the mouth of the Ruphia (Alpheios). Its harbour is at Katakolo, with which and with Athens there is railway communication, and it carries on a large trade. Pop. (1896), 12,705.

PYRO-ELECTRICITY, a name given to electricity produced in certain crystals by mere change of temperature. Thus, when a crystal of tourmaline is heated, one end, called the *analogous pole*, becomes positively electrified, and the other, the *antilogous pole*, negatively electrified. When cooled, the poles are reversed. Crystals of boracite and other substances behave in the same way, but topaz, prehnite, and others, though electrified by heating, do not develop polarity. Most pyro-electric crystals are hemihedral.

PYROGALLIC ACID, or **PYROGALLOL** ($C_6H_2O_5$), an acid obtained by heating gallic acid to $210^\circ C$, when carbon dioxide is given off and pyrogallol sublimes. It crystallizes in plates or needles that have neither smell nor colour, is readily soluble in water but less easily in alcohol and ether, and has a neutral reaction. It is extensively used in photography, and sometimes as a hair-dye, and it has also been employed for curing certain forms of skin disease. In an alkaline solution it readily absorbs oxygen, and for this purpose it is much used in gas-analysis.

PYROLA, the type-genus of the Pyrolaceae or Winter-Green order. See WINTER-GREENS.

PYROLUSITE, a black ore of manganese, occurring crystallized and massive in Devonshire, Warwickshire, Thuringia, Brazil, and other places. It is the binoxide or peroxide of manganese, and is much used in chemical processes. See MANGANESE.

PYROPE, fire-garnet or Bohemian garnet, a dark-red variety of garnet, found embedded in trap tufa in the mountains of Bohemia. It occurs also in Saxony in serpentine. See GARNET.

PYROPHONE, a musical instrument, in which the various notes are produced by the burning of

hydrogen gas within glass tubes of various sizes and lengths. It is also called a *flame-organ*, and was invented about 1875 by a Frenchman called Kastner. He was born at Strasburg in 1852 and died at Bonn in 1882, and published a work (*Les Flammes Chantantes*, Paris, 1875) explaining the principle of his invention.

PYROSCOPE, an instrument for measuring the intensity of heat radiating from a hot body, or the frigorific influence of a cold body. It is constructed on the same plan as a differential thermometer, one bulb being covered with silver leaf and the other being left uncovered. Leslie was its inventor.

PYROSIS, in medicine, a disease of the stomach attended with a sensation of burning in the epigastrium, accompanied with an eructation of watery fluid, usually insipid, but sometimes acrid. It is commonly called *Water-brash*. See **DYSPEPSIA**.

PYROXYLINE, a term embracing gun-cotton and all other explosive substances obtained by immersing vegetable fibre in nitric or nitro-sulphuric acid, and then suffering it to dry. These substances are nitro-derivatives of cellulose. See **GUN-COTTON**.

PYRUS, or **PIRUS**, a very important genus of ornamental and fruit trees, belonging to section *Pomeæ* of the natural order *Rosaceæ*. They have simple or pinnate leaves with deciduous stipules, and conspicuous white or pink flowers in cymes

or corymbæ. The petals are five in number, and the five calyx-lobes often adhere to the top of the fruit, which is a fleshy pome formed by the upgrowth of the receptacle so as to envelope the carpels. The stamens are numerous, and the carpels usually five in number. There are about forty species, natives of the north temperate and cold regions. The pear (*P. communis*), the apple or crab (*P. Malus*), service-tree (*P. torminalis* and *domestica*), mountain-ash or rowan-tree (*P. Aucuparia*), beam-tree (*P. Aria*), &c., all belong to this genus. The medlars and the quinces are sometimes included in this genus. See articles on the trees enumerated.

PYTHAGOREAN BEAN, the *Nelumbium speciosum*. See **NELUMBIACEÆ**.

PYTHAGOREAN THEOREM, the forty-seventh proposition of the first book of Euclid's Elements, which shows that in any right-angled triangle the square on the hypotenuse is equal to the sum of the squares on the other two sides.

PYTHONESS, the priestess of Apollo at his temple at Delphi, who gave oracular answers. See **DELPHI**.

PYXIDIUM, or **PRYSIS**, in botany, a capsule with circumscissile dehiscence so that the top comes off like a lid, as seen in henbane (*Hyoscyamus*), Pimpernel (*Anagallis*), and in the fruit of *Lecythis Ollaria*, the monkey-pot tree, a large forest tree of Brazil. The term is also applied to the theca of mosses.

Q.

QUADRIGA, an ancient two-wheeled car or chariot drawn by four horses abreast. It was used in racing in the Greek Olympian games, and in the games of the Roman circus. See **CHARIOT**.

QUADRILATERAL, a name given to the space inclosed between, and defended by, four fortresses in Northern Italy famous in Austro-Italian history, namely, Peschiera and Mantua on the Mincio, and Verona and Legnago on the Adige. Warsaw, Ivan-gorod, Brest-Litovsk, and Novogeorgievsk are the fortress-corners of what is called the Polish Quadrilateral.

QUAIN, SIR RICHARD, distinguished physician, was born at Mallow, county Cork, on Oct. 30, 1816, of an Irish family of good position. Educated at the Diocesan School of Cloyne, he became pupil to a surgeon-apothecary in Limerick. In 1837 he began his medical course in University College, London, where two of his cousins were teachers and where he gained great distinction, graduating M.B. in 1840 and M.D. in 1842. He was elected a fellow of University College in 1843, and a member of the Royal College of Physicians in 1846, of which he became fellow in 1851, and subsequently vice-president and member of the council. For a number of years succeeding 1848 he was connected with Brompton Hospital for diseases of the chest. In 1871 he was chosen a fellow of the Royal Society, and he was also connected with many other learned associations. Queen Victoria in Council appointed him a Crown representative on the General Medical Council in 1863, and from 1891 till his death on Mar. 13, 1898, he was its president. He was one of the chief members of the Royal Commission on the rinderpest appointed in 1865. In 1891 he was created a baronet. He was honorary LL.D. of Edinburgh and honorary M.D. of Dublin. His practice in London was large and lucrative. Besides publishing several medical

treatises he edited a well-known Dictionary of Medicine (1882; new ed., 1894)

QUAMASH, the North American name of *Cumassia esculenta*, a plant of the lily family with an edible bulb. It has long, narrow, grooved leaves, and flower-stalks fully a foot long bearing several blue or white flowers. It grows abundantly in the swampy plains of north-western America. The bulbs are much eaten by the Indians, and are prepared by baking in a hole dug in the ground, then pounding and drying them into cakes for future use.

QUAMOCLIT, a genus of climbing ornamental plants of the natural order Convolvulaceæ. The heart-shaped leaves are arranged alternately, and the red flowers spring singly or in clusters from the leaf-axils. They are chiefly found in the hot parts of America, but some species are indigenous both in India and China. It is by some botanists regarded as a section of the genus *Ipomœa*.

QUANDANG, the edible drupaceous fruit of a species of sandalwood tree, *Santalum acuminatum*, called in Australia native peach. It is one of the best of native Australian fruits.

QUANTAMPOH, a town of Western Africa, in the Ashantee kingdom, about 100 miles north of Coomassie, and the seat of a considerable trade. Pop. 15,000.

QUANTOCK HILLS, a range of low elevation in England, in the county of Somerset, extending from the Bristol Channel, near Watchet, north-east to between Bridgewater and Taunton, and rising at their highest point (Willsneck) to an elevation of 1270 feet above the sea-level. They are mainly composed of greywacke, and on the eastern slopes limestone is quarried.

QUANZA, a river of Africa. See **COANZA** in **SUPP.**

QU'APPELLE, a small town on the Canadian

Pacific Railway, in the district of Assiniboia, about 40 miles to the east of Regina. The town stands on a river of the same name, which flows into the Assiniboine. Pop. (1901), 842.

QUAREGNON, a commune and colliery district of Belgium, in the province of Hainaut, 4 miles west of Mons. It is a station on the railway from Mons to Valenciennes, and has various manufactures, the chief being tobacco. Pop. 14,361.

QUARNERO, GULF OF, in the Adriatic Sea, between Istria and the Croatian coast, 15 miles in length and breadth. It is nearly inclosed leewards by the islands of Cherso and Veglia, and communicates with the Adriatic by three channels, of which the central one is known by the name Quarnerolo. The seamen of that region dread the gulf on account of the terrific storms to which it is subject. There are important fisheries.

QUARTERLY REVIEW, an English review published every three months, founded in February, 1809, in opposition to the Whig Edinburgh Review, by John Murray, with the support of Canning, Sir Walter Scott, and other leaders of the Tory party. William Gifford was its first editor. From 1826 to 1853 it was presided over by Lockhart, the biographer and son-in-law of Scott. From 1867 to 1894 it was under the editorship of Dr. (Sir) William Smith. The Quarterly has from the first held a foremost place as a critical review.

QUARTERN, a term sometimes used to designate the fourth of a peck, or of a stone; as, the quatern-loaf. In liquid measure it is the fourth part of a pint.

QUARTO (4to), a book of the size of the fourth of a sheet; a size made by twice folding a sheet, which then makes four leaves. See PRINTING.

QUARTZITE, QUARTZ-ROCK, a metamorphic stratified granular-crystalline rock consisting entirely, or almost entirely, of quartz. It is usually a sandstone which has been altered by heat, &c. It is generally of a grayish or pinkish-gray colour, from a slight trace of iron.

QUASS, or KVASS, a sour, fermented liquor, made by pouring warm water on rye or barley meal, and drunk by the peasantry of Russia. A mixture of kvass and bread is known as *tvara*.

QUATHLAMBA MOUNTAINS, a range in South Africa, forming the western boundary of Natal. It is also called the Drakenberg Mountains (which see in SUPP.).

QUATREFAGES DE BRÉAU, JEAN LOUIS ARMAND DE, French naturalist, was born of an old Protestant family at Berthezène, in the department Gard, on Feb. 10, 1810. After a course of study in the college of Tournon, he entered the University of Strassburg, where he graduated with high distinction both in mathematics and in medicine. About 1832 he settled in Toulouse as a medical practitioner, and soon afterwards he founded the *Journal de Médecine et de Chirurgie de Toulouse*. In 1838 he gave up his practice in order to lecture on zoology at the Faculty of Sciences in that city, and in 1840 he took up his residence in Paris. Here he devoted himself especially to the study of the Invertebrates, and in 1844 he accompanied Milne-Edwards on a scientific tour to Sicily and other parts of Europe. He was appointed professor of natural history at the Lycée Napoléon in 1850, and two years later he became a member of the Academy of Sciences. From 1855 till his death he held the professorship of anthropology at the Musée d'Histoire Naturelle. He died in Paris on Jan. 12, 1892. His most important works, some of which have appeared in English translations, are the following: *Souvenirs d'un Naturaliste* (1854); *Études sur les Maladies*

Actuelles des Vers à Soie (1860); *Unité de l'Espèce Humaine* (1861); *Métamorphose de l'Homme et des Animaux* (1862); *Histoire Naturelle des Annelés Marins et d'Eau Douce* (1865); *Les Polynésiens et leurs Migrations* (1866); *Histoire de l'Homme* (1867); *Ch. Darwin et ses Précurseurs Français* (1870); *La Race Prussienne* (1871), which led to a controversy with Virchow; *L'Espèce Humaine* (1877); *Hommes Fossiles et Hommes Sauvages* (1884); *Les Pygmées* (1887); *Introduction à l'Étude des Races Humaines* (1887-89); *Théories Transformistes* (1892); and *Crania Ethnica* (with Hamy, 1872-82). Quatrefages was an opponent of Darwin's chief theories.

QUATREFOIL, in architecture, an opening or a panel divided by cusps or foliations into four leaves, or more correctly the leaf-shaped figure formed by the cusps. It is an ornament which has been supposed to represent the four leaves of a cruciform flower, and is common in the tracery of Gothic windows. Bands of small quatrefoils are much used as ornaments in the perpendicular Gothic style, and sometimes in the decorated. The same name is also given to flowers and leaves of similar form carved as ornaments on mouldings, &c.

QUEBRACHO, the name given to several trees of different genera, but with similar qualities, indigenous to South America, valuable alike for their wood and their bark. The red quebracho (*Loropeterygium Lorentzii*, family Anacardiaceæ) is very hard, but splits easily. The bark and wood are used in tanning. The white quebracho (*Aspidosperma quebracho*) belongs to the dogbane order (Apocynaceæ), and is used for wood-engraving. The bark contains six alkaloids, and is used therapeutically as a remedy for asthma, being employed as a decoction and a tincture. It grows plentifully in the Chilian province of Santiago.

QUEENBOROUGH, a municipal borough of England, in the county of Kent, 2 miles south of Sheerness, on the Swale at its junction with the Medway, whence a line of steamers runs to Flushing, affording a direct and rapid transit to the Continent. It was built by Edward III. and named after his queen. It has an oyster-fishery which has declined considerably. Pop. (1891), 1050; (1901), 1546.

QUEEN-OF-THE-MEADOWS. See SPIRÆA.

QUEENSBURY, a town of England, in Yorkshire (W. Riding), $4\frac{1}{2}$ miles south-west of Bradford, with an old church (restored), several chapels, Victoria Hall and Institute, Albert Memorial fountain, &c. It has factories for the manufacture of alpaca, mohair, and worsted, also collieries and quarries. Pop. (1891), 6740; (1901), 6416.

QUEEN'S-PIGEON, a magnificent ground-pigeon inhabiting the islands of the Indian Ocean, named after Queen Victoria. It is one of two species constituting the genus *Goura* (*G. Victoriae*), and is the largest and most beautiful species of the order. See PIGEON.

QUEENSTOWN, a town of eastern Cape Colony, situated on a plateau between the Stormberg and the Amatola mountains, on the railway from East London to Aliwal North, 155 miles by rail north-west of the former. It contains a fine town-hall, a court-house, and public offices, some good churches, a hospital, and other buildings and institutions, and there is a well-laid-out botanic garden. Pop. 4000.

QUEEN'S-YELLOW, the yellow sub-sulphate of mercury, or turbith mineral, used as a pigment.

QUELPART, a rock-bound island, 43 miles long by about 17 broad, off the south coast of Corea, of which it is a penal settlement. The soil is fertile, wheat, barley, turnips, and other crops being widely cultivated; and the climate temperate. The in-

terior is mountainous, and one summit, the volcanic Mount Auckland, is 6700 feet high. Area, 750 square miles; pop. about 10,000, nearly all Coreans.

QUERCUS. See OAK.

QUERIMBA ISLANDS, a chain of low coral-line islands extending along the east coast of Africa, about the mouth of the Mtepesi river, and comprised in the Portuguese territory of Mozambique. There is a town and fort on the chief of them, Ibo.

QUETELET, LAMBERT ADOLPHE JACQUES, Belgian statistician and astronomer, was born at Ghent on Feb. 22, 1796, and studied at the lyceum of his native town, where, in 1814, he became professor of mathematics. In 1819 he was appointed to the same chair in the Brussels Athenæum. In 1828 he became lecturer in the Museum of Science and Literature, holding the post till 1834, when the institution was merged in the newly-established university. Quetelet superintended the erection of the Royal Observatory, and became its first director (1828). A member of the Belgian Royal Academy, he became its perpetual secretary in 1834. From 1836 he was professor of astronomy and geodesy at the Brussels Military School. He died on Feb. 17, 1874. Quetelet's writings on statistics and kindred subjects are very numerous. He also published many papers on meteorology, astronomy, terrestrial magnetism, &c. Of his works we may mention *Sur l'Homme et le Développement de ses Facultés, ou Essai de Physique Sociale* (1835); *Sur la Théorie de Probabilités appliquée aux Sciences morales et politiques* (1846); *Sur le Système Social et les Lois qui le régissent* (1848); *Histoire des Sciences Mathématiques et Physiques chez les Belges* (1864); and *L'Anthropométrie* (1871). Quetelet sought to apply the mathematical methods of averages and probabilities to the study of man as an individual and as a member of society.

QUETTA, a town of Beloochistan, strategically important to India as being at the entrance to the Bolan Pass, and on the road from Candahar through the Pishin valley to Shikarpur on the Indus. It thus commands the southern route from India to Afghanistan. By treaty with the Khan of Kelat (1877), in whose territory it is, Quetta has been furnished with a British garrison and strongly fortified. It contains extensive magazines of war material, and was in 1885 connected with the Indus by a line of railway. It lies about 5500 feet above the sea-level, and is surrounded by mountains. It has become a flourishing place since the British occupation. The head-quarters of the British agent in Beloochistan is here.

QUEZAL, a most beautiful Central American bird of the Trogon family (*Pharomacrus mocinno* or *resplendens*). It is about the size of a magpie, and the male is adorned with tail-feathers from 3 to 3½ feet in length, and of a gorgeous emerald colour. These feathers are not, strictly speaking, the true tail-feathers (the colour of which is black and white), but are the upper tail-coverts of the bird. The back, head (including the curious rounded and compressed crest), throat, and chest are of the same rich hue, the lower parts being of a brilliant scarlet. The female wants these long feathers, and is otherwise much plainer. The food of the quetzal consists chiefly of fruits. It lives in forests of tall trees. There are several allied species of birds, but none with the distinctive features of the quetzal. See TROGONS.

QUIBDO, a town in the state of Cauca, of the Republic of Colombia, South America, on the Atrato, a little south of the parallel of 6° N. It was formerly the capital of Chocó. Pop. 7800.

QUIBOR, a town of Venezuela, in the state of

Lara, division Barquisimeto, about half-way between Barquisimeto and Tucuyo. Pop. 8000.

QUICHUA, the name of a native race of South America, inhabiting Peru, parts of Ecuador, Bolivia, &c. With the Aymaras the Quichuas composed the larger portion of the population of the empire of the Incas. The Quichua language, which was formerly the state language of the Incas, is still the chief speech of Peru, of a large portion of Bolivia, of the part of Ecuador bordering upon Peru, and of the northern section of the Argentine Republic. It is one of the most beautiful and at the same time comprehensive tongues of America. The habits of the Quichuas differ but little from those of the Aymaras (which see in SUPP.).

QUICK-FIRING GUNS, a type of ordnance of recent introduction, consisting of breech-loading guns of comparatively small size, the projectile and powder for which are combined together in a metallic cartridge-case, so that loading and firing are thus facilitated. They are mounted on special carriages provided with steel shields to protect the gunners, are fitted with special gear for handling and aiming, and are fired by electricity. See GUN.

QUILLAI-BARK (*Quillai Saponaria*), the bark of a South American tree belonging to the division Spirææ of the order Rosacææ. The tree has smooth, oval leaves, and white terminal flowers, either solitary or in small clusters. The bark is in several layers and contains abundance of carbonate of lime and similar substances. It is used to make a lather instead of soap in washing silks, woollens, &c. Recently a preparation of it has been introduced into Britain as a hair-restorer. It is called also *Quillaya-bark*.

QUILOA, or KILWA, a seaport of German East Africa, on the Zanzibar coast. Kilwa Kiswani, or insular Kilwa, is situated on an island close to the coast about half-way between the mouths of the Ukeru and Rufiji; the more recent Kilwa Kivinja, or continental Kilwa, is on the mainland about 18 miles to the north. The climate of both is very unhealthy, and they are of very little importance. Formerly they had a considerable trade, especially in slaves. Pop. about 10,000.

QUILON, a coast town of Madras, India, in the state of Travancore, 35 miles north-west of Trivandrum, the capital, with a considerable export trade. It has a cantonment for troops, a hospital, and an Episcopal church. The Portuguese established a fort and factory here in 1503. Pop. (1891), 15,375.

QUIMPERLÉ, a town of France, in the department of Finistère, beautifully situated among hills at the confluence of the Isole and Ellé, which here form the Laita, 27 miles east-south-east of Quimper. It carries on a trade in grain, timber, cattle, &c., and there are several manufacturing establishments. The old church of Ste. Croix is interesting, but that of St. Michel, dating from the fourteenth century, is more attractive. There are several curious old houses. Quimperlé grew up in connection with the abbey of Ste. Croix, founded in 1029. Pop. (1896), 4883.

QUINCUNX, an arrangement of five objects in a square, one at each corner and one in the middle, thus . . . It is particularly employed in reference to the arrangement of trees.

QUI-NHON, a town near the eastern coast of Annam, with a harbour. It is connected by the highway called the Mandarins' Road with Hué, on the north, Xuan Day on the south, and the other chief towns of the coast. It is open to European commerce.

QUIPO, QUIPU, a cord about 2 feet in length, tightly spun from variously coloured threads, and to

which a number of smaller threads were attached in the form of a fringe. It was used among the ancient Peruvians and Mexicans for recording events, &c. The fringe-like threads were also of different colours and were knotted. The colours denoted sensible objects, as white for silver, yellow for gold, and the like; and sometimes also abstract ideas, as white for peace, red for war. They constituted a rude register of certain important facts or events, as of births, deaths, and marriages, the number of the population fit to bear arms, the quantity of stores in the government magazines, &c.

QUIRINAL, one of the seven hills of ancient Rome. There is a palace here, begun in 1574, and formerly a summer residence of the popes, but since 1871 the residence of the King of Italy. See **ROME**.

QUITTAH, or **KITA**, a town on the coast of West Africa, in the British colony of the Gold Coast, in about lon. 1° E. It is situated near a lagoon of the same name. Pop. 5000.

QUORRA, a name given to the lower portion of the Niger (which see).

QUOTIDIAN FEVER. See **AGUE**.

R.

RA (more properly **Rê**), the name of the god of the sun among the ancient Egyptians. He is represented, like **Horus**, with the head of a hawk, and bearing the disk of the sun on his head. *Tum*, *Harmachis*, and other gods are mere impersonations of the various attributes of **RA**.

RABBA, a town of the Western Soudan, in the Kingdom of Gando (Northern Nigeria), on the left bank of the Niger, some 350 miles from its mouth, with a considerable trade in slaves and ivory, and manufactures of woollen. Pop. said to be about 40,000.

RABBET, in carpentry, a sloping cut made on the edge of a board so that it may join by lapping with another board similarly cut; also, a rectangular recess, channel, or groove cut along the edge of a board or the like to receive a corresponding projection cut on the edge of another board, &c., required to fit into it.

RACALMUTO, a town of Sicily, in the province of Girgenti, with mines of sulphur, salt, and quick-silver. It has railway connection with Girgenti, Licata, and other towns in the island. Pop. 15,000.

RACCAHOUT, a starch or meal prepared from the edible acorn of the Barbary oak (*Quercus Ballota*), sometimes recommended as food for invalids. Mixed with sugar and aromatics it is used by the Arabs of Northern Africa as a substitute for chocolate.

RACHIS, or **RHACHIS**, in botany, a branch which proceeds nearly in a straight line from the base to the apex of the inflorescence of a plant. The term is also applied to the stalk of the frond in ferns, and to the common stalk bearing the alternate spikelets in some grasses.

RACHITIS, a term which properly implies inflammation of the spine, but it is applied to the disease called *Rickets*, which term suggested this as the scientific name. See **RICKETS**.

RACK, in machinery, a straight or slightly curved metallic bar, with teeth on one of its edges, adapted to work into the teeth of a wheel or pinion, for the purpose of converting a circular into a rectilinear motion, or vice versa. It is equivalent to an arrangement of two toothed wheels, one of which has an infinitely great diameter.

RADAUTZ, a town of Austria, in the duchy of Bukowina, 37 miles south-west of Czernowitz, with a government stud of horses and manufactures of machinery, glass, paper, beer, and spirits. It is the terminus of a branch from the railway through Czernowitz and Sutschawa. Pop. (1890), 12,895.

RADHANPUR, a petty state of British India, in the north-west of Gujerat, having Baroda on the east and Warâhi on the west, with an area of 1150

square miles. The state came under British protection in 1819. Pop. (1891), 98,129.—The capital of the state has the same name. Pop. (1891), 14,175.

RADICAL (from *L. radix*, root), the name adopted by a large section of the Liberal party in Britain, which desires to have all abuses in the government completely rooted out, and a larger portion of the democratic spirit infused into the constitution. The term was first applied as a party name in 1818 to Henry Hunt, Major Cartwright, and others, who wished to introduce radical reform in the representative system. Since then the immediate aims of radicals at different times have necessarily varied considerably; and though the party is now identified almost exclusively with political reform, the radicals of the past achieved their greatest success in compelling attention to important economic changes tending to improve the condition of the labouring population.

RADIOGRAPHY and **RADIOSCOPY**, a new kind of photography and a method of seeing objects through opaque media which involve the use of the Röntgen-rays or X-rays, discovered in 1895 by Wilhelm Konrad Röntgen, since 1888 professor of physics in the University of Würzburg. Professor Röntgen explained his discovery in a communication made to a learned society of Würzburg in 1896, and supplemented it by an account of some later experiments in the following year. Since then physicists in every civilized country have followed up his researches, and an immense number of valuable observations on the nature, effects, and applications of the new rays has been accumulated. The discovery is of the utmost importance both theoretically and practically, but as yet fruitful inquiry has been almost confined to the latter aspect of the matter. On the theoretical side Professor Röntgen's discovery is one of those which open up entirely new paths to scientific investigation, and throw fresh light upon those ultimate problems in which both the scientist and the philosopher are interested. An eminent Frenchman, M. Poincaré, has described the X-rays as 'a new agent, as new as was electricity in the time of Gilbert, galvanism in the time of Volta'.

Professor Röntgen's discovery was made, partly by accident, in the course of investigations into the cathode-rays, which were first studied by Sir William Crookes. These rays emanate from the cathode or negative electrode in a bulb-like glass vessel, known as a Crookes tube, in which a very high vacuum has been created, and through which an electric discharge from an induction-coil is passed. The tube used by Röntgen was a Hittorf tube, which differs from a Crookes tube for practical purposes only in

the fact that the rarefaction of the air is carried further. He found that when such a tube, in which cathode-rays were being generated, was entirely inclosed in a box of black paper, a substance opaque not only to ordinary light, the light of the electric arc, and the ultra-violet chemical rays, but also to the cathode-rays, some kind of emanation of a radial nature passed through the box and produced fluorescence on a screen coated with the platino-cyanide of barium. He found also that the fluorescent effect of these invisible rays was not destroyed by the interposition between the box and the screen of a book of one thousand pages, several thicknesses of tin-foil, blocks of wood, a lamina of aluminium, ebonite plates, the hand, several gases and liquids, thin plates of copper, silver, lead, gold, and platinum, and other substances, though in some of these cases a light shadow was projected on the screen. He soon ascertained that these rays, which he named X-rays from their unknown nature, influenced a photographic plate exactly in the manner of ordinary light (or, more strictly, the ultra-violet rays of ordinary light), and that any interposed object was shown on the developed plate by a kind of shadow or silhouette, whose degree of depth depended on the extent to which the object absorbed the X-rays. Thus, if the human hand with a ring on one finger were interposed, the resulting photograph, or *radiograph*, would show the flesh in very light shadow, the bony skeleton in deeper shadow, and the ring, which is practically opaque to the rays, in very deep shadow. Other substances besides barium platino-cyanide were shown to fluoresce under the influence of the new rays, among them calcium sulphide, Iceland spar, and rock-salt. He stated that the invisibility of the rays was not due to the opacity of the media of the eye, but some subsequent investigators claim to have disproved this. He found that the path of the rays was rectilinear, that they were not refracted or reflected (at least in the ordinary sense), that they showed no interference phenomena and could not be polarized, that they discharged electrified bodies, positive and negative alike, and that they were not deviated by a magnet. Some of his experiments revealed a most intimate connection between the cathodic rays and the X-rays. The latter invariably proceeded from the point on the surface of the glass where the cathode-rays impinged, and subsequent experiments showed that they were given forth from any substance upon which the cathode-rays were caused to fall. But, though in some way intimately related to the cathodic rays, the Röntgen-rays are quite distinct from them. The cathode-rays are deviated markedly by a magnet, whilst the X-rays are not deviated at all; and the cathode-rays, though obtained by Lenard outside the tube, cannot act through air nearly as far as those of Röntgen. Moreover, the cathodic rays, which appear to be in some way electrified, discharge only negatively-electrified bodies, whilst the X-rays discharge positively and negatively electrified bodies indifferently. Several physicists, notably M. Becquerel, have proved that certain bodies, such as the salts of uranium, can, under certain circumstances, emit invisible rays which traverse opaque bodies and act in other ways exactly like the X-rays; but these rays, now usually called *Becquerel rays*, can be readily reflected, refracted, and polarized, like ordinary light. On the other hand, the so-called *black light* of M. Le Bon, discovered in 1896, presents many notable points of difference from the X-rays in respect of the absorptive power of different bodies for it.

The nature of the Röntgen-rays is still entirely unknown; the x has not yet been determined.

Crookes advanced his celebrated theory of radiant matter to account for the cathodic rays, and, though apparently disproved for a time by the researches of Goldstein, Hertz, Wiedemann, and others, this hypothesis has again come into favour in recent years. According to this view the cathode-rays consist in the actual emission of particles of matter in a special condition, and it is thus easy to explain their deviation by a magnet, their action on electrified bodies, and some other of their properties. This emissive hypothesis has also been suggested in regard to the X-rays, but in this case it presents more serious difficulties. If, however, it be established for the cathodic rays, the intimate connection between these and the X-rays would lead us to expect it to be true of the latter also; and if that supposition were well-founded, the secret of the difference between the two kinds of radiation would have to be sought for in the action of the cathode-rays on the surface of the glass or other body upon which they impinge. The facts that the Röntgen-rays are not refracted, reflected, or polarized, like ordinary light, make it extremely probable that they cannot be due to transverse vibrations in the ether; but some physicists think that this objection to the transverse-wave theory is not insurmountable. Röntgen himself suggested that they may be longitudinal ether waves, and this explanation is by no means an improbable one. Of those who regard them as transverse undulations, most incline, from their analogies to the ultra-violet rays, to describe them as ultra-ultra-violet. M. Dufour ascribes to them an electric origin; and M. Zenger of Prague holds that they do not exist at all, and that the radiographs are due to electric energy.

The apparatus for the production of the rays consists essentially of two parts: (1) an induction-coil or influence-machine, and (2) a vacuum-tube or Röntgen lamp. The induction-coil, operated by an electric battery or accumulator, should be a powerful one, though the use of a Tesla transformer makes a smaller coil sufficient. The circuit should contain a resistance-coil and an ampère-meter in order that the intensity of the current may be under control. A Wimshurst or other influence-machine is used by some physicists instead of a battery and coil. The form of vacuum-tube in universal use now is that known as the *focus-tube*, from the fact that the cathode-rays are brought to one point on the surface where they impinge, thus securing that the X-rays shall radiate in a conical fashion from a single point. The cathode is a spherical mirror of platinum placed near one end of the tube, and the anode a small plate of the same metal, with its centre situated exactly at the focus of the cathode mirror, and its surface inclined at 45° to the line joining the centres of the two electrodes. The cathode-rays are by this means focussed on the central point of the anode, and from it the X-rays spread out in the form of a cone at right angles to the impinging cathode-rays. The anode is usually placed at or near the centre of a spherical part of the tube. If a Tesla transformer be employed, both electrodes become cathodes in turn; and in this case accordingly both are spherical mirrors, and they are so arranged as to have the same focus on the surface of a suitably-placed reflecting plate of platinum. If the vacuum be very high, the tube is described as *hard*; otherwise it is *soft*. A hard tube enables a radiograph to be taken with a short exposure, but the rays are less absorbed than in the other case, and the radiograph consequently shows but little detail. For most purposes a soft tube is preferable, and several arrangements for controlling the vacuum have been devised. The photographic plate used in radiography is completely

wrapped up in paper or inclosed in a case, and the object to be radiographed is then placed upon it in the most convenient manner. The Röntgen-bulb is then brought near enough to the object to act with reasonable rapidity, though not so near as to prevent the rays from spreading over the whole of the plate. After the suitable exposure the plate is developed in the ordinary way, and a shadow-photograph or radiograph is obtained.

Just as radiography is based upon the action of the X-rays upon a photographic plate, so radioscopy depends upon their action on a screen coated with platino-cyanide of barium or calcium, calcium tungstate, or other substance in which fluorescence is produced. The screen will show shadows wherever the rays have been to any extent absorbed, and the depth of these shadows is a measure of the degree of absorption. The *cryptoscope* or *fluoroscope* of Salvioni consists simply of a fluorescent screen connected with a binocular arrangement not unlike a stereoscope, by which an observer is enabled to see the shadows on the screen without the interference of side light. If it be directed towards any object behind which an X-ray bulb is suitably placed, a shadow-picture of the object will be seen on the screen. M. Seguy's *lorgnette humaine* is essentially the same instrument, adapted to the examination of the human body for medical and surgical purposes.

The applications of radiography and radioscopy are already myriad. The most important are those in medicine and allied sciences, to which it has furnished a new method of diagnosis, an infallible means of locating foreign objects, projectiles, &c., in the interior of the body, even in the skull, as well as of examining fractures, observing vital processes, and studying the structure of the organs, and also a curative agent of some value in cases of lupus and other cutaneous diseases. It has been employed with good results in their special studies by botanists, zoologists, geologists, mineralogists, and palaeontologists; it enables counterfeit gems to be distinguished at once from real ones; it has been used by postal and customs authorities to detect breaches of their regulations; and even the police authorities of some countries have found it of service. It is said to afford an infallible test of the adulteration of certain food-stuffs; and in many other ways its practical utility has been abundantly proved.

RADIOMETER, an instrument designed for measuring the mechanical effect of radiant energy. It consists of four crossed arms of very fine glass, supported in the centre by a needle-point having at the extreme end thin discs of pith, blackened on one side. The instrument is placed in a glass vessel exhausted of air, and when exposed to rays of light or heat the wheel moves more or less rapidly in proportion to the strength or weakness of the rays.

RADSTOCK, a town of England, in Somersetshire, 8 miles south-south-west of Bath, with an old church (rebuilt) having some interesting features; several other places of worship, working-men's institute, &c. Coal is mined in the neighbourhood. Pop. (1891), 3438; (1901), 3365.

RAE, JOHN, M.D., LL.D., Arctic traveller, was born near Stromness, in the Orkney Islands, on Sept. 30, 1813. At the age of sixteen he went to study medicine at Edinburgh, and became surgeon in the Hudson's Bay Company's service in 1833. From 1835 till 1845 he was the company's resident surgeon at Moose Fort, and in 1846 he set out northwards on an exploring expedition, which extended into the following year, and included the survey of upwards of 700 miles of coast. On returning from this journey he went to London, and in the following year he accompanied Sir John

Richardson in his Franklin search (1848-49) in the Mackenzie and Coppermine region. He conducted two expeditions in 1851, during the first of which he explored a large part of the coast of Wollaston Land. During the second he travelled a distance of over 5000 miles in eight months, and explored much of the coast of Victoria Land. In 1853-54 he again conducted an expedition, and this time his party discovered the first traces of Franklin's fate, for which the party received the government grant of £10,000. He published *Narrative of an Expedition to the Shores of the Arctic Sea in 1846-47* (1850). Edinburgh University granted him the honorary degree of LL.D. He died in London on July 25, 1893.

RAFF, JOSEPH JOACHIM, musical composer, was born at Lachen on Lake Zurich, Switzerland, of German parents, on May 27, 1822, and died on June 24, 1882. He was educated at Wiesenstetten (Württemberg) and at the Jesuit Lyceum at Schwyz. He was encouraged by Mendelssohn and Liszt, and having gone in 1850 to live at Weimar, in order to be near Liszt, his opera, *König Alfred*, was first performed there at the Court Theatre. His *Dame Kobold*, a comic opera, was produced in 1870, but his reputation rests chiefly on his symphonies (*Im Wald*, *Lenore*, *An das Vaterland*, &c.). He wrote also much chamber music of undoubted excellence, and his industry may be inferred from the number of his works, considerably over two hundred. In 1877 he was appointed director of the Conservatoire at Frankfort, where he died. He was a supporter of the Wagner school in music, and in 1854 he published a pamphlet on *Die Wagnerfrage*. Two post-humous overtures, *Romeo and Juliet*, and *Macbeth*, were published in 1894.

RAFFAELLO. See **RAPHAEL**.

RAFFIA. See **RAPHIA** in **SUPP.**

RAGEE, RAGGER, an Indian grain (*Eleusine coracana*), very prolific, but probably the least nutritious of all grains. In the form of cake or porridge it is the staple food of the poorer classes in Mysore and on the Neilgherries. It is also known as *natohnee*, and in Abyssinia it is called *tocussa*.

RAGHUVANSA, the title of one of the most celebrated Sanskrit poems. Its subject is the legendary history of the solar kings, or kings descended from the sun. See **SANSKRIT**, and **KĀLIDĀSA**.

RAGNARÖK, in Scandinavian mythology, literally twilight of the gods or doom of the gods, the day of doom when the present world will be annihilated, to be reconstructed on an imperishable basis. The title of the concluding portion of Wagner's great operatic trilogy is a translation of this word, *Die Götterdämmerung*; and in that work is depicted the downfall of Wotan and the gods and the triumph of perfect human love. See also various works by William Morris.

RAGOUT (French, *ragoût*), meat or fish stewed with vegetables, and highly seasoned to excite a jaded appetite.

RAGSTONE, a stone of the siliceous kind, so named from its rough fracture. It effervesces with acids, and gives fire with steel. It is used for a whetstone without oil or water for sharpening coarse cutting tools. It is abundant in Kent, at Newcastle, and elsewhere. The term is also applied to certain limestones which contain many fragments of shells resembling rags.

RAGWORT, **RAGWEED**, the popular name of various species of composite plants of the genus *Senecio*, found in Britain, so called from the ragged appearance of the leaves. The common ragwort (*S. Jacobae*) is a perennial with golden-yellow flowers, growing by the side of roads and in pastures. It is a coarse weed, refused or disliked by horses, oxen,

and sheep, but eaten by hogs and goats. The specific name perpetuates an older name of the plant, St. James's wort; other old names having reference to supposed healing virtues are stammerwort and stagger-wort. Another rather smaller British species with somewhat larger flower-heads is *S. aquaticus*, the water ragwort, found in marshy and moist places. A third species resembling these two is the narrow-leaved ragwort (*S. erucafolius*). Groundsel belongs to the same genus.

RAHEITA, a sultanate on the western side of the Strait of Bab-el-Mandeb, situated immediately north of the French territory of Obock. Its limits are rather indefinite, and it is now included in the Italian colony of Eritrea.

RAIATEA, one of the Society Islands in South-eastern Polynesia, situated north-west of Tahiti; area, 75 sq. miles; pop. 2300, who have been converted to Christianity by English missionaries and are all Protestant. The island now belongs to France. It is mountainous, well-watered, and fertile, reaching a height of about 3400 feet. The chief products are cotton and copra.

RAI BARELI, a town of Oudh, India, administrative head-quarters of a district of the same name, on the banks of the Sai, 48 miles s.w. of Lucknow. There is a bridge over the Sai, several interesting ancient structures, and the usual government buildings. Pop. (1891), 18,798.—The district forms part of the Lucknow division, has an area of 1751 square miles, and a population (1891) of 1,036,521.

RAIGARH, a native state of India, in the Central Provinces; area, 1486 square miles; pop. (1891), 168,525. None of the soil is very good, but portions are well-cultivated, rice being the chief crop. There is a large amount of iron-ore, but it is not much worked. The chief town is also called Raigarh.

RAIDÆ, the family of fishes to which the rays (skate, &c.) belong. See **RAY**.

RAIKES, ROBERT, founder of the Sunday School system, was born at Gloucester on Sept. 14, 1735. On his father's death in 1757 he succeeded to his printing business and the proprietorship of the Gloucester Journal, which his father had founded in 1722. In 1768 he used his paper to expose certain abuses in the prisons of his native city, and five years later he met Howard, the great philanthropist. In 1780 he started a Sunday school in conjunction with a curate named Thomas Stock, and before long many similar schools began to be established in various parts of the country. In 1785 he and William Fox with some friends founded a society in London to encourage the development of the new system, and in 1803 the Sunday School Union was founded. Raikes lived in retirement from 1802 till his death at Gloucester on April 5, 1811. He was a benevolent and generous man, but some of his contemporaries regarded him as rather vain.

RAIKOT, a town of Hindustan, in the Lúdhiana district of the Punjab, surrounded by a wall and substantially built, formerly the capital of a native state. Pop. (1891), 9381.

RAINFORD, a town of England, in Lancashire, 10 miles north-east of Liverpool, with tobacco-pipe works, collieries, &c. Pop. (1891), 3472; (1901), 3359.

RAIN-TREE (*Pithecolobium saman*), a leguminous tree of tropical America, now largely planted in India for the shade it furnishes, and because it flourishes in barren salt-impregnated soils, as well as for its sweet pulpy pods, which are greedily eaten by cattle. Another species, with edible pods, *P. dulce*, is a native of Mexico, but has been introduced into the Philippine Islands and also into India. The species of *Pithecolobium* have bipinnate leaves and somewhat twisted pods.

RAIS, or **RETZ**, GILLES DE LAVAL, SEIGNEUR DE, French marshal, was born in 1396. He distinguished himself in the wars with the English, and has acquired a disgraceful celebrity for outraging and murdering 140 or 160 children, and for other atrocities. He was hung and burnt at Nantes on Oct. 25, 1440, for his crimes. There is, however, good reason for doubting the truth of these facts.

RAISED BEACHES. See **BEACHES**, **RAISED**.

RAJÁPUR, two towns in India: (1) In the Ratnagiri district of the Bombay Presidency, at the head of a creek 15 miles from the sea. Pop. (1891), 7784. (2) In the Banda district of the N.W. Provinces, on the Jumna. It has a considerable but declining trade in country produce, &c. Pop. (1891), 6136.

RAJPIPLA, a native state of India, in Bombay Presidency, watered by the Nerbudda. It is traversed by the Rajpipla hills, which reach a height of about 2000 feet above sea-level. The soil in the Nerbudda valley is fertile and well-cultivated; there are also carnelian mines in the state. Area, 1514 sq. miles; pop. (1891), 171,771. The capital is Nandod.

RAJSHAHI, a division or commissionership of Bengal, extending from the Ganges to Sikkim and Bhutan. Area, 17,351 square miles; pop. (1891), 8,019,187.—The district of Rajshahi, forming part of the division, has an area of 2330 sq. miles; a pop. (1891) of 1,313,336. The capital of the division and district is Rámpur Beaulah.

RÁLE, in pathology, a noise or crepitation caused by the air passing through mucus in the bronchial tubes or lungs. There are various ráles—the *crepitant*, the *gurgling*, the *sibilant*, the *sonorous*, &c. The rále or rattle which precedes death is caused by the air passing through the mucus, of which the lungs are unable to free themselves. See **DRATH**.

RALIK ISLANDS, the western group of the Marshall Islands (which see in SUPP.).

RALLIDÆ, a family of birds. See **RAIL**.

RAM, **HYDRAULIC**. See **HYDRAULICS**.

RAMA, in Hindu mythology, the name common to a personage appearing as three incarnations of Vishnu, all great warriors of surpassing beauty. These three forms are distinguished as Bala Rama or Balaram, Parasurama or Parasram, and Rama Chandra or Dasrat Rama. In the poem called Ramayana these three heroes are celebrated, but the last-named, or Rama Chandra, has his life and deeds detailed at greater length than the others. See **AVATAR**.

RAMBOOTAN, the fruit of the tree *Nephelium lappaceum*, belonging to the natural order Sapindaceæ, much prized in the Malayan Archipelago. It is about the size of a pigeon's egg, and of a red colour. It is said to be rich and of a pleasant acid taste. The fruits Litchi and Longan (which see) are obtained from other trees of this genus.

RAMÉE, LOUISE DE LA, better known by her pseudonym of OUIDA, English novelist of French extraction, was born at Bury St. Edmunds in 1840, and has latterly lived much in Italy. She began writing for periodicals at an early age, and published her first novel, *Held in Bondage*, in 1863. Since then she has produced many novels, including *Strathmore* (1865); *Chandos* (1866); *Under Two Flags* (1867), probably her best work; *Idalia* (1867); *Puck* (1870); *Folle-Farine* (1871); *Pascarel* (1873); *Sigma* (1875); *In a Winter City* (1876); *Friendship* (1878); *Moths* (1880); *Wanda* (1883); *Princess Napraxine* (1884); *A Rainy June* (1885); *A House Party* (1887); *Guideroy* (1889); *Ruffino* (1890); *Position* (1890); *Santa Barbara* (1891); *Tower of Taddeo* (1893); *The Silver Christ* and *A Lemon Tree* (1894); *Massarenes* (1897); *Toxin*, an Altruist (1897); *La Strega* (1899); and *The Waters of Edera*

(1900). Ouida has enjoyed a great popularity and most of her novels have been translated into French or other languages. They cover a somewhat wide range both of scenery and society; but she has little insight into human nature; and, though she has identified herself with various humanitarian movements, she has but little sympathy with humanity in its ordinary phases. In 1895 she published a volume of Views and Opinions, and one of Critical Studies in 1900. Street Dust (1901) is a collection of short stories.

RAMÉE, PIERRE DE LA. See RAMUS.

RAMGARH, a town of India, in Jaipur state, Rajputana, 100 miles to the north-west of Jaipur. It contains the palatial residences of many rich bankers. Pop. (1891), 12,197.

RAMSAY, SIR ANDREW CROMBIE, geologist, was born at Glasgow on Jan. 31, 1814, and received his education at Saltcoats and in his native city. As a young man he took a great interest in geology, his first work, The Geology of Arran, gaining him a reputation and an appointment in 1841 on the Geological Survey of the United Kingdom, of which he afterwards, in 1845, became a local director. In addition to this position he held the professorship of geology at University College, London, from 1847 till 1851, when he became lecturer on geology at the School of Mines. On the death, in 1871, of Sir Roderick Murchison, he was appointed director-general of the Geological Survey, and when he retired from this post in 1881 he received the honour of knighthood. He died at Beaumaris on the 9th December, 1891. He was president of the Geological Society in 1862-64, and of the British Association in 1880, and he was a fellow of the Royal Society and of other learned societies. Besides the work already mentioned he published: The Geology of North Wales (1858); Old Glaciers of North Wales and Switzerland (1860); Physical Geology and Geography of Great Britain (1st ed., 1853; 5th ed., 1878); and many valuable monographs, chiefly on theoretical questions in geology. He was at once an acute observer and an original thinker; and it is to Sir Andrew Ramsay that geological science is indebted for the established doctrines regarding denudation, and the explanation of the origin of rock basins by means of glacial action. See the Life by Sir A. Geikie (1895).

RAMSAY, EDWARD BANNERMAN, Scottish clergyman, son of Alexander Burnett, advocate, was born at Aberdeen on Jan. 31, 1793, and died at Edinburgh on Dec. 27, 1872. He adopted the name of his grand-uncle Sir Alex. Ramsay, by whom he was educated. Educated at Cambridge, he took holy orders and came to Edinburgh in 1823 as a clergyman of the Scottish Episcopal Church, becoming dean of the diocese in 1846. He is best known by his Reminiscences of Scottish Life and Character (1858), which has had a great popularity. Several other works, chiefly sermons and lectures, were also published by him. He took an active interest in all matters pertaining to the Scottish Episcopal Church.

RAMSAY, WILLIAM, chemist, nephew of Sir Andrew C. Ramsay, the geologist, was born in Glasgow on Oct. 2, 1852. He was educated at the Glasgow Academy and at the University of Glasgow, and in 1871 he went to study chemistry at Tübingen. From 1872 till 1874 he was chief assistant to the Young professor of technical chemistry in Anderson's College, Glasgow, and for the next six years he

acted as tutorial assistant to the professor of chemistry at the university. In 1880 he accepted the chair of chemistry in University College, Bristol, of which he was appointed principal in the following year. These posts he held till his appointment in 1887 as professor of chemistry in University College, London, a chair which he still occupies. He was elected a Fellow of the Royal Society in 1888, and he is also a member of many other learned bodies both at home and abroad. His name is specially associated with the discovery of several new gaseous elements existing in minute quantities in the atmosphere and in certain minerals. The first of these, known as *argon*, was obtained by him from the nitrogen of the atmosphere in 1894. In this discovery Prof. Ramsay was associated with Lord Rayleigh, but in his subsequent isolation of the elements *helium*, *krypton*, *neon*, and *xenon* he worked mostly alone. He is the author of several works on chemistry and of many papers in the transactions of various scientific societies.

RAMSAY, WILLIAM MITCHELL, archaeologist and student of early Christian history, was born in Glasgow on March 15, 1851. He was educated at Old Aberdeen, and at the universities of Aberdeen, Oxford, and Göttingen. In 1882 he was elected Fellow of Exeter College, Oxford, and in 1884 he obtained a fellowship in Lincoln College. He was Oxford travelling student in 1880, and from that date onwards he has travelled widely in Asiatic Turkey. In 1885 he was appointed to the chair of classical archaeology in Oxford University, and since 1886 he has held the professorship of humanity (Latin) in the University of Aberdeen. He has received honorary degrees from Oxford, St. Andrews, and Cambridge. Prof. Ramsay has made a special study of the geography and topography of Asia Minor, and his works give evidence of great erudition. These include, besides a large number of articles in periodicals, The Historical Geography of Asia Minor (1890), a most important work in its department; The Church in the Roman Empire before A.D. 170 (1893), dealing with St. Paul in Asia Minor and the early persecutions of the Christians; The Cities and Bishoptics of Phrygia (two vols., 1895-97); St. Paul the Traveller and the Roman Citizen (1895; trans. into German, 1897), practically a commentary on the greater part of the Acts of the Apostles; Impressions of Turkey (1897); Was Christ born at Bethlehem? (1898); and a Historical Commentary on the Epistle to the Galatians (1899). His wife is also known as an author, having written Everyday Life in Turkey (1897), &c.

RAMSONS, *Allium ursinum*, a species of garlic found wild in many parts of Britain, and formerly cultivated in gardens, it being used for culinary purposes, like the common garlic (*A. sativum*). It is a broad-leaved plant with white flowers, and when bruised gives out the disagreeable smell of garlic. It grows commonly in moist shady places, in woods, hedge-banks, &c., sometimes in fields, and when eaten by cattle imparts the unpleasant taste and smell of garlic to milk and butter.

RAMTEK, a town of India, Nagpur district, Central Provinces, 24 miles north of Nagpur city, celebrated as a holy place, and the resort of great numbers of pilgrims. Pop. (1891), 7514.

RAMTIL OIL, a bland oil similar to sesamum oil, expressed from the seeds of a composite annual herb, *Guizotia oleifera*, cultivated in Abyssinia and various parts of India. See SESAMUM.

